DOCUMENT RESUME

ED 248 123 SE 044 772

AUTHOR Kahuki, Isaiah Njau
TITLE Evaluation of Three Course Patterns for the Implementation of Science Laboratory Technician Curriculum in Applied Sciences. African Studies in Curriculum Development & Evaluation.
INSTITUTION African Curriculum Organisation.
SPONS AGENCY German Agency for Technical Co-Operation, Nairobi (Kenya).; Kenya Inst. of Education, Nairobi.; Nairobi Univ. (Kenya).
PUB DATE Aug 83
NOTE 91p.; Requirement for the Post-Graduate Diploma in Curriculum Development, University of Nairobi. Portions of document in light type.
PUB TYPE Reports - Research/Technical (143) -- Dissertations/Theses - Undetermined (040) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Academic Achievement; *College Science; *Course Organization; Curriculum Development; Curriculum Evaluation; Higher Education; *Paraprofessional Personnel; Program Length; *Retention (Psychology); Science Education; Teacher Attitudes
IDENTIFIERS *Kenya; Science Education Research

ABSTRACT

Three course patterns are currently available to laboratory technician trainees in Kenya. Students may select the full time option (attending classes full time), the sandwich option (alternating between a term of employment and a term of full time studies), or the day release option (attending classes one full day per week from 8:00 a.m. to 6:30 p.m.) until the course is completed. This research examined whether any of these three patterns is superior to the others. Specific areas investigated included the differences in mean scores at the end of the course, the opinions of lecturers regarding the three patterns, and how much of the practical skills and theoretical knowledge taught is retained by the trainees in each of the three patterns. Findings indicate that students in full time classes performed better on the final examination than students in day release classes and that there were no differences in the attitudes of lecturers toward the three course patterns. Several recommendations are offered based on these and other findings. For example, the fulltime and sandwich patterns are appropriate for the weaker student who needs a boost in examination performance. (Supporting documentation, including questionnaires used and additional data, are provided in appendices.) (JN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Peter Sachsenmeier

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SE 041 772

African Studies
in Curriculum Development & Evaluation

General Editors: Peter Sachsenmeier
Kofi B. Quansah

No. 93

I. KAHUKI:

EVALUATION OF 3 COURSE PATTERNS FOR THE IMPLEMENTATION OF SCIENCE CURRICULUM: APPLIED SCIENCES.

A.C.D. Project
C/o A.M.D. Sachsenmeier
P.O.Box 6[illegible], Nairobi

This research project was undertaken as part of a training programme jointly organised on behalf of the African Curriculum Organisation (ACO) by the Kenya Institute of Education (KIE), the University of Nairobi, and the German Agency for Technical Cooperation (GTZ).

EVALUATION OF THREE COURSE PATTERNS.

FOR THE IMPLEMENTATION OF SCIENCE LABORATORY TECHNICIAN CURRICULUM IN APPLIED SCIENCES.

BY

ISAIAH NJAU KAHUKI.

Submitted to the Faculty of Education, University of Nairobi as part fullfilment of the requirements for the award of Post Graduate Diploma in Systematic Curriculum Development.

Nairobi August 1983.

TABLE OF CONTENTS.

TITLE	PAGE.
INTRODUCTION/DESCRIPTION	1
THE PROBLEM	6
OBJECTIVES	7
DEVELOPMENT AND ADMINISTRATION OF RESEARCH INSTRUMENTS	8
HISTORICAL DATA ANALYSIS	12
Junior Laboratory Technicians (JLT)	12
Final Examination performance by the Pre-technician (G2) candidates	19
Final Examination performances by the Biological Laboratory Technician (BLO) students	26
Final results for the Science Laboratory Technicians (SLO)	29
Summary - Historical data	34
ANALYSIS OF THE QUESTIONAIRES	40
Response from lecturers	41
Response from Higher National Diploma students	45
The response from Graduates	49
CONCLUSION	53
Discussion	55
Recommendations	56
APPENDIXES	58
ACKNOWLEDGEMENTS	79
REFERENCES	80

CHAPTER ONE

INTRODUCTION:

There has been a persistent problem among science laboratory technicians trainees with regard to the course pattern to adopt for instruction. The three current ones open to them are: Full time, sandwitch and Day Rele ase Patterns.

A number of factors have been used in the past to guide the applicant into making up his mind. There has not been any documented evidence as to which pattern is superior to the others. The main purpose of this research project is to investigate whether any of the three patterns is superior to the others, using data collected at the Kenya Polytechnic, Nairobi.

DESCRIPTION:

The Kenya Polytechnic, Nairobi, has an annual average of over 3,800 trainees. These students enter into various technicians courses in 10 teaching/Learning departments. These courses may be of a duration, ranging from on 13 week term, to three years. These technician courses range in level of competency from Pre-technician, through Junior technicians ordinary Diploma to Higher National Diploma levels.

Irrespective of the level of competency, a trainee may take the course in any one of three patterns. The patterns are explained below:-

Fulltime:

In this pattern, the student attends classes from 8.00 a.m. to 4.00p.m. for five days a week. This continues for a 13 week term for 3 terms a year until the course is completed.

Sandwitch:

This couse pattern is similar to the fulltime pattern. But the difference between them is that the student is still in fulltime employment and attends classes at the college in alternate school terms. That means that, while a fulltime student will attend classes at college virtually every term, the sandwitch student will attend classes either one term in one year and two terms the following year or vice versa.

Day Release:

This pattern is completelydifferent from the other two. The student attends classes on one full day (8.00 a.m. to 6.30 p.m.) a week until the couse is completed. For certain levels, the afternoon (2.00 P.M to 6.30 p.m.) or just another evening (4.30 p.m. to 6.30p.m) of another day have to be added to the full day.

All the students take an equal college holiday after the 13 week term irrespective of the course pattern.

These systems of course attendance were inherited from the British system and they date as far back as 800 A.D. during the great industrial revolution. During the revolution, it was necessary to have high and up-to-date technical staff output. It was generally observed that when the working staff took classes in evenning (Night school) to update themselves, they tended to have better and higher output than those who were first trained before taking up jobs (T.R.Kinyanjui)[a]. Thus the day release, block release and sandwitch patterns came into being alongside the fulltime pattern. Prior to 1974, the patterns of the courses at Kenya Polytechnic were the day release, the full-time and the block release (the latter involved spliting the 13 week term into two halves whereby the student spent one half in college and the other half at his centre of operation. But since that pattern does not exist now, it is not included in the evaluation study). The sandwitch was introduced by 1974 according to the recommendations of the Kenya Polytechnic Planning committee[b]. The committee called it:-

introduction of seven term attendance pattern. It was immediately implemented by the Building, Electrical and mechanical engineering departments and to a lesser extent by the science department. In the $2^1/3$ year course, it was already understood to give 1440 hours in collge which was less than the contact hours available in the dayrelease and the block release patterns it was to replace.

(a) Personal Communication

(b) Aid proposal and development plan 1974-78

The committee reasoned that it would give better rate of teaching hours to attendance hours since it would reduce the proportionate time spent in registration and class administration. The new pattern would also reduce the total time to final qualification from 3 years to $2^1/3$ years. With this pattern, it was felt that more evening teaching spaces would be made available. This time could then be used for a true "Night school".

For reasons not explained in this report, not all departments accepted this shift of course pattern. The science department (now Applied Sciences department) proposed to continue with the day release and fulltime courses in addition to the 7 term sandwitch pattern. The Printing department opted to offer day-release and fulltime courses only while the Business studies and Institutionalmanagament departments chose to continue with full time classes.

Since then, there has not been any evaluation of these course patterns, this being the 10th year since they started to co-exist.

Irrespective of the course pattern, nearly all the courses at the Kenya Polytechnic are designed to train people as they work in various industries and institutions. Hence, about 95% of the courses require employer sponsorship. This sponsorship may or may not imply payment of college fees. From the college perspective, the employer provides the real life opportunity for practical work to the student. The college therefore insists that, besides the fact that the trainee is employed, he is doing duties related to the area of study.

This not only motivates the student to learn but it also makes the studies move purposeful and encourages the student to contribute in the decision making of the course content.

The employer of the trainee on the other hand views the sponsorship as an investment. The employer therefore is rightly concerned with what the trainee is being taught and how he is taught. The result is that the employer has the upper hand in deciding what and how his employee is to study, rather than the trainee. The insistence by the college that a trainee study especially the fields directly related to his work is very much in agreement with the decision of employers in general. Therefore seldon do disagreements arise on the choice of subjects between the employer and the college. Also, between the college and the trainee, there's normally very little disagreement in that field. When it does occur, it is because the student has ideas for another job. It therefore means that the only area of contention is in the pattern of attendance.

For the purpose of this research, the teaching learning of Applied Sciences that take place in the Applied Science Department been used. This department is ideal due to the fact that it conducts courses at all the levels mentioned above and also, all course patterns are represented.

This department has an average of 42 classes running during any one term. It has a fulltime teaching force of 27 lecturers and a fluctuating parttime teaching force of 12 lecturers on the average.

At the beginning of each term, there are students enrolling and at the end of everyterm, there are students graduating. The number of students enrolling vary from term to term. In the January term, the total enrolment in the department is about 200 trainees.

In the May and September terms, it is about 150 respectively. During any one term, there are 600 to 800 students in the department.

THE PROBLEM

Every term, when new trainees are being enrolled, there has always been repeated cases of disagreement between the recruiting officer (for the college) and the new trainee about the course pattern to enrol in. Othertimes, the disagreement is between the recruiting officer and the Training Officer (the employer). At other times, it is between the employer and the trainee.

The reasons advanced by the trainee or the employer for the choice of particular course patterns are seldom related to the excellence of achievement by the end of the course. Those reasons are often based on economic, administrative or social aspects. The reasons advanced by the recruiting officer are usually administrative and academic excellence. There has also been a general disagreement between members of the teaching staff as to which pattern prepares trainees best of all.

So far, there has not been a documented report in this area, despite the fact that the entire institution is committed to excellence in industrial performance by its graduates.

Knowledge in this aspect of superiority of certain course patterns would help in the designing of curriculum implementation patterns. Such knowledge is not only helpful to the department of Applied Sciences but also to the entire college, and other colleges. Such other colleges include the government training colleges for the private sector like Mombasa Polytechnic, Directorate of Industrial Training and Utalii College, the Company operated centres and others like the Institutes of technology (c). The research findings would also give the relevant training officers an important basis against which to weigh their other consideration in choosing of course patterns.

OBJECTIVES:

By using historical data, questionnaires on old graduates of the college, the Higher National Diploma students and the lecturers, the research will investigate comparatively:

1. whether there are any significant differences in mean scores at the end of the course.
2. The opinions of lecturers with regard to the three patterns.
3. How much of the practical skills and

theoretical knowledge is retained by the trainees with each of the three patterns.

(c) Development Plan 1979-83

CHAPTER TWO.

DEVELOPMENT AND ADMINISTRATION OF RESEARCH INSTRUMENTS.

This chapter explains the kinds of research instruments used, how they were developed, how the samples of study were selected and how the instruments were administered.

HISTORICAL DATA.

The Registrars department of the Kenya Polytechnic keeps the records of all the students. This record includes the performance of students on the final examinations. The final examinations records of 5 years were used for this study. These were results of 1978 to 1982 and in some cases from 1976 to 1980. The applicable records were these of the graduates of the Applied Science Department, who took their courses in either Fulltime, Sandwich or Dayrelease patterns. The relevant courses were then to be:-

Pre-technician (G2)

Junior Laboratory Technician (JLT)

Science Laboratory Technician Certificate Part I (SLO).

Biological Laboratory Technician Certificate Part I (BLO).

Since the Laboratory Technican Certificate Part II was always taken in the Dayrelease pattern, it would not provide useful data. It could not offer basis for comparisons.
The examination records from the Registrars department do not show the details regarding the pattern of attendance. This information was obtained from the class registers.
From the Applied Science Departmental archives therefore, the students names/numbers from each course pattern were identified. These numbers were then used in classifying the examination information from the registrar's department, into course patterns. In some cases, the examination records were only available in the departmental records.

Tables were then prepared showing the level of study for each year, the pattern of attendance, the mean grade scores in the theory and practical examinations.

Example:-

Table showing mean grades of JLT classes in the theory and Practical examinations for 1981.

EXAM. \ PATTERN	DAYRELEASE N=22	FULLTIME N=32
Theory	5.09	4.72
Practical	4.45	4.31

Similar tables were prepared for each one of the four courses for each year. Where possible, the individual subject grades were also indicated.

The data covered the results of 1008 students with regard to their theory scores and practical scores. Analysis of whether there were significant differences between the means were carried out as per course each year. Where significant differences were established, then the superiority relationship between the course patterns was identified.

THE LECTURER SAMPLE.

A questionaire, seeking the opinion of lecturers regarding the three patterns of course attendance was developed. The questionaire was administered to 24 memebers of the teachning staff. This number excludes the head of the department, his deputy, the researcher and the part-time lecturers. The first two, are instrumental, either to the formulation or to the perpetuation of the course patterns. Their responses therefore may not all-together be unbiased. The part time lecturers normally teaching the day release classes. Being a special type of sample, it was inadequate without corresponding part-time lecturers (or they themselves) teachning classes in the other patterns.

The information sought by the lecturers questionaire was grouped into 5 categories.

a) The specific level and course pattern for which the information was supplied.

b. How prepared the teacher was for theory and practical classes.
c. How fully the syllabus was covered (i.e. scope).
d. How well the syllabus was covered (i.e. depth).
e. The attitude of the lecturer to each pattern.

The questionaire was handed out directly to each lecturer and collected after 3 days. From the information abotained through this questionaire, analysis was carried out to establish the superiority pattern of the three course patterns as viewed by the lecturers.

HIGHER NATIONAL DIPLOMA (HND) STUDENTS SAMPLE.

Most of the students taking the Higher National Diploma (HND) courses have at least gone through the Science Laboratory Technician Part I course. Some have even gone through the Pre-technician course. A questionaire was developed for a sample of 100 HND students, both in their first and second years. This number was the total of all HND students in the department at the time of study. It was administered after the morning tea-break for the first ½ hour. This is a time when the whole class was bound to be in.

The questionaire sought information regarding:-

a). Specific level and pattern of the course the student attended.
b). How prepared he was before a lesson.
c). How much was learnt in theory and practicals.
d). How prepared the teachers were.

From the information, the 3 course patterns were rated. This was to show the view of the on-going students who would not be taking courses in a any other pattern save dayrelease pattern. The last three categories of information were used to quantify how much was learnt and retained by the students. This is the third objective of the survey.

GRADUATES' SAMPLE.

A questionaire for the old graduates of the department was prepared. In this context, old graduates were considered to be these who graduated between 1978 and 1981. The assumption here was that, after about 3 years, the graduate is reasinably indipedent of the college, but, can still look back vividly at the course he took with a reasonable degree of appreciation. The sample comprised of about 10 people from ten of the major

The sample comprised of about 10 people from ten of the major beneficiaries of the Applied Science Department. These included:-

Kabete Veterinary Laboratories.
Nairobi University.
Kenya Breweries Limited,
Kenyatta University College.
Kenya Agricultural Research Institute (Muguga).
National Agricultural Laboratories (Kabete).
Kenya Polytechnic.
Dawa Pharmaceuticals Limited.
Wellcome (Kenya) Limited.
Kenya Bureau of standards.

The graduates' questionaire differed from the one designed for HND students in that it required a fifth type of information. This fifth information was the respodents general personal evaluation rating of how much theory and practical he still remembers.

After taking the questionaires to the graduates at their various centres, the researcher personally collected them after 3 days in most cases.

As with the preceeding two questionaires, the rating of the three course patterns was done. This was to help find out the evaluation of the course patterns by old graduates of the department.

The findings and analysis are dealt with in chapter three. Copies of the repective questionaires are included in the report as appendixes 6,7 and 8.

CHAPTER THREE.

In this chapter, the questionaires and historial data are analysed. The kind of information obtained from each questionaire was different from that of the other questionaires and from historical data. Each one of those sources was given separate treatment. The analysis of each source will be shown under the appropriate subheading.

HISTORICAL DATA ANALYSIS.

The historical data was collected so as to investigate whether there were significant differences between the course patterns. This was the first objective of the survey.
The performance by students in different course patterns was available for the respective four classes. Consequently, each class received separate analysis. These classes are Junior Laboratory Technician (JLT), the Pre-Technician (G2), Biological Laboratory Technician (BLO) and the Science Laboratory Technician (SLO) courses. The analysis is presented in that order.

JUNIOR LABORATORY TECHNICIAN (JLT).

The JLT full examination results per subject were only available from 1980 to 1983 inclusive. The 1979 examination results were scantily but they have also been analysed. The detailed results and standard deviations for different mean scores in the JLT examinations of 1979 to 1983 are given in Appendix I.

The 1979 JLT results for the Day release classes were available only in the overall grade form. Even then, they showed the class performance, simply as Distinction, Credit, Pass or Fail. For computation purposes, these classes were assigned values as follows:

CLASS	SCORE
DISTINCTION	1.5
CREDIT	3.5
PASS	5.5
FAIL	7.5

These values were adopted to correspond with the grades awarded by the Kenya National Examinations Council (KNEC) for the Science Laboratory Technician courses. The grade are respectively:

1 and 2 for good and poor distinctions.
3 and 4 for good and poor credit.
5 and 6 for good and poor pass.
7 and 8 for fail and poor fail.

The results of the JLT fulltime class for 1979 were available as per subject. But, without the marks for these subjects in Day/release classes, those results could not be used. Since these fulltime class overall results were available in grades instead of class intervals, the respective grades were pooled to show the frequencies per class. The results of the analysis are shown in Table I below.

TABLE I: Results of the 1979 JLT Examination.

MARKS / PATTERN	day/release N=21	FUlltime N=20
mean	5.12	4.90
Standard deviation	1.50	1.47

The t-test computation (formular given in Appendix 2) showed that these overall grades were not signficantly different at a significance level of P = 0.05.

TABLE 2: The Examination results for JLT 1980.

This table shows the results obtained in Physcis, Chemistry, Biology, Laboratory technology, Drawing/workshop and the overall grades for 1980 JLT examinations. The lower the mean grade, the better the performance..

TABLE: 2: Mean Exam results for JLT 1980.

SUBJECT / pattern	DAY/RELEASE N = 21	FULLTIME. N = 30
PHYSICS	4.67	4.27
CHEMISTRY	4.48	4.37
BIOLOGY	4.19	4.57
LAB.TECHNOLOGY	4.71	4.17
DRAWING/W/SHOP	4.52	4.43
OVERALL	4.90	4.67

Using the significance level of P = 0.05 as the critical level, the mean score in anyone subject or the overall results are not different between the day release and the fulltime class.
The mean overall grade for all the classes are a mean of the actual overall grade that each candidate got. They are not a mean of the subject means. There are factors that may make the final grade not reflect a mean of the subject grades. If a student fails in three subjects, he cannot get a pass. If he fails in two subjects, he cannot get a credit. Consequently the overall mean grade is bound to be equal to, or poorer than the mean of the subject mean scores. This situation is bound to arise even in subsequent calculation.

TABLE 3: Examination results for JLT 1981.

The JLT 1981 examination results are given as grades where the lower the grade, the better the performance. The practical results are also included.

TABLE: 3: Examination results for JLT 1981.

PATTERN / SUBJECT	DAY/RELEASE N= 22	FULLTIME. N= 32
PHYSICS	4.64	4.34
CHEMISTRY	4.23	4.63
BIOLOGY	5.18	3.97
LAB.TECHNOLOGY	4.45	4.47
DRAWING/W/SHOP	4.77	4.22
PRACTICAL	4.45	4.31
OVERALL	5.09	4.72

After a t-test computation, the fulltime mean grades in Biology and Drawing/Workshop were found to be superior to these of the day release at a significance level of P = 0.05. On the practical performance, the overall grade and all other subjects, the two groups were not significantly different.

TABLE 4 : Results of the 1982 JLT Examinations.

This table shows the mean grades obtained by Day/release and Full-time JLT classes in the 1982 examinations. The lower the mean values, the better the performance.

TABLE 4: Mean grades obtained in the JLT 1982 Exams.

PATTERN / SUBJECT	DAY/RELEASE N = 25	FULLTIME N = 17
PHYSCIS	4.96	3.71
CHEMISTRY	5.12	3.41
BIOLOGY	4.88	3.76
LAB.TECHNOLOGY	5.04	3.65
DRAWING/W/SHOP	4.96	3.53
PRACTICAL	5.04	4.12
OVERALL	5.44	4.64

These mean scores show that the fulltime class had better mean grades than the day release class in every subject. This was proved using the t-test at the significance level of P = 0.05. The practical and overall grades were also superior for the fulltime class to those for the day release at that significance level.

RESULTS OF THE 1983 JLT EXAMINATIONS.

These results are shown in the table below in the table below of the mean grades. The lower mean grades imply better performance correspondingly.

Table: 5: Mean grades obtained in JLT 1983 Exams.

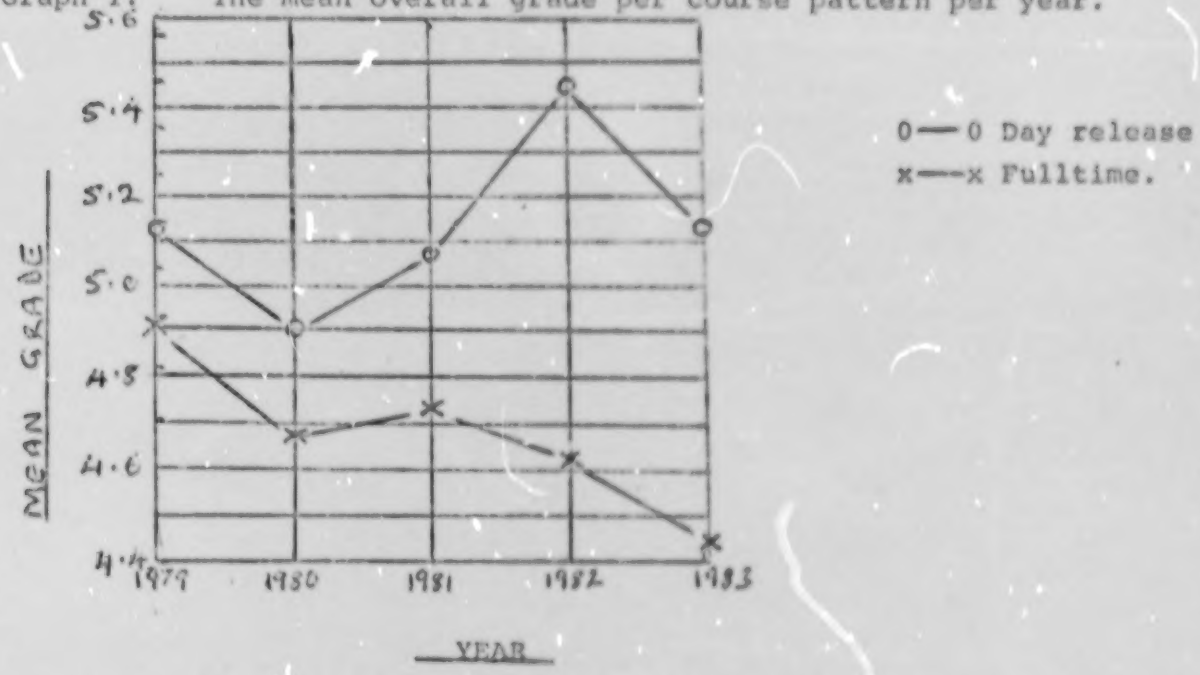
SUBJECT. / PATTERN	DAY RELEASE N= 47	FULLTIME N= 27
Physics	5.11	4.19
Chemistry	3.84	2.77
Biology	4.94	4.37
Lab. Technology	4.53	3.81
Drawing/W/Shop	3.23	2.33
Practical	6.48	5.11
Overall	5.11	4.44

The apparent superiority by the fulltime class over the day release one was subjected to the t-test. It was found that in each subject, practical and overall grade, the fulltime class was significantly better than the dayrelease class. This was calculated at the P = 0.05 significance level.

SUMMARY.

The following graph shows the summary of the performance in overall grade by the two groups. It covers the 5 year period analysed (1979 - 1983).

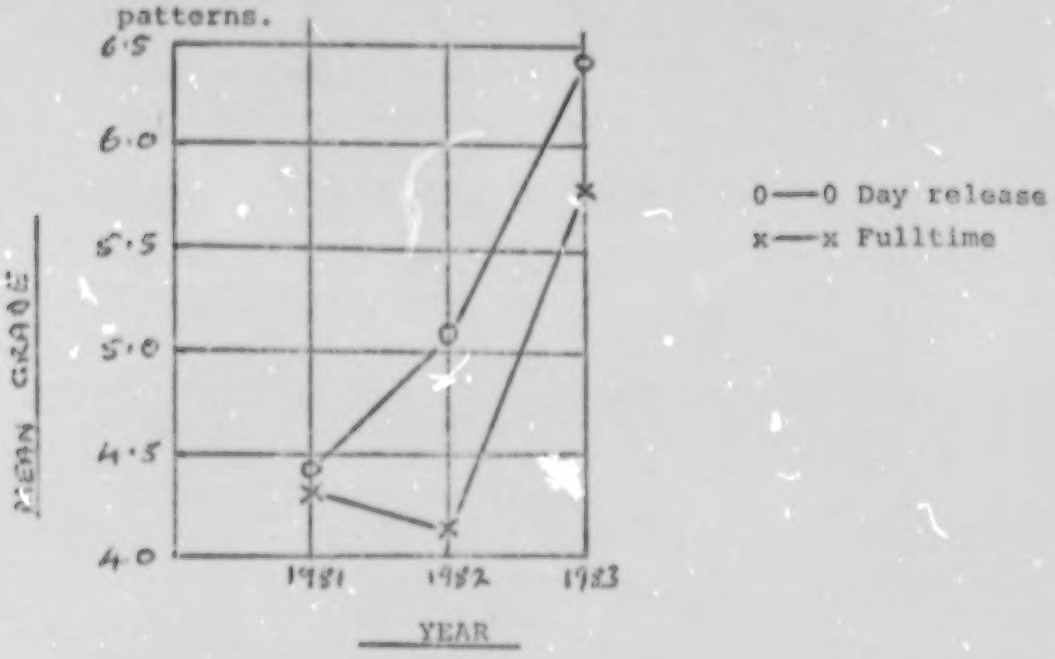
Graph 1: The mean overall grade per course pattern per year.



For the 5 years (1979 - 1983) the fulltime course pattern has given better mean grades than the day release course pattern in JLT. This better performance was significant in 1982 and 1983 at P = 0.05. While the trand has been consistently gradual improvement from 4.9 to 4.44 for the fulltime classes, the day release clasres have yielded inconsistent results.

The practical performance in the three years when data was available is summarised below in graph form.

Graph 2: Practical grades obtain in 3 years in different course patterns.



This graph shows that the fulltime class has always had better mean grades in the practicals. These differences have been significant for 1982 and 1983 at P = 0.05,.

FINAL EXAMINATION PERFORMANCE BY THE PRE-TECHNICIAN (G2) CANDIDATES.

The analysis of the G2 examination results was conducted in respect of the first objective. This means, finding out whether there are significant differences in performance at the end of the course between different course patterns.

The pre-technician (G2) students have not always done the same subjects from year to year. In 1978 and 1979, there was no technical Drawing Subject. Workshop was only examined in 1979. Occassional variations were also observed in subjects between the fulltime and the dayrelease classes of the same year. In 1979 the day release students did not take drawing while the fulltime students did. The results of the practical performance were not available for the years 1979, 1980 and 1981. Because of these variations, a greater sample of results was used for the G2 analysis. These are results over 6 year period from 1978 to 1983 inclusive. For computation of the results, the subjects for which results were not available for both course patterns have been left out here, Nevertheless, they are included in Appendix 3 with other calculation for the G2 examinations.

The results of the G2 examinations are shown in grade form like the JLT examinations. This means that the lower the grade, the better the performance.

TABLE 6: Examination results for 1978 G2.

The performance in the 1978 G2 examinations was available in class form. The mean grade value for each class was used with the corresponding frquencies to determine the mean grade per class per subject. The values were:

GRADE	VALUE
DISTINCTION	1.5
CREDIT	3.5
PASS	5.5
FAIL	7.5

After computing using these values and frequencies, the man grades were obtained. These are shown in Table 6.

TABLE 6: The 1978 G2 mean examination results.

PATTERN / SUBJECT	DAY/RELEASE N = 18	FULLTIME N = 21
MATHS	5.06	4.45
PHYSCIS	4.72	4.64
CHEMISTRY	4.61	4.93
BIOLOGY	4.61	4.64
ENGLISH	4.27	5.02
PRACTICALS	5.06	4.00
OVERALL	4.70	4.55

When these mean grade scores by the two groups were subjected to a t-test, it was found that in the practicals, the fulltime class was significantly superior to the day release class at P = 0.05 In the other subjects and overall average grade, there was no significant difference between the two groups.

TABLE 7: The 1979 G2 Examination results.

The table 7 shows the mean grade performance by each group per subject and in overall performance. The practical examination results for 1979 were not available.

TABLE 7: Mean grade results for 1979 G2 examinations.

PATTERN / SUBJECT	DAY/RELEASE N = 18	FULLTIME N= 41
MATHS	4.61	4.49
PHYSICS	4.50	4.56
CHEMISTRY	4.17	4.59
BIOLOGY	4.44	4.75
ENGLISH	4.11	4.63
OVERALL	4.61	4.73

This data appears to indicate a superior performance by the day release class. But the t-test statistic revealed that there was no significant difference between the two different patterns in any one subject. This was concluded after considering a significance level of P = 0.05 as the critical level.

TABLE 8: The 1980 G2 Examination results.

In the 1980 G2 Examinations the technical drawing was not done by the day release class. It was only done by the fulltime class. For that reason, its analysis has not been represented in table 8. It is however included in the results shown in appendix 3 where the standard deviations in G2 examinations are all included. The practical results were not available for either class and hence, they are not included anywhere in the analysis. The lower the grade, the better the performance.

TABLE 8: Mean grade results for 1980 G2 Exams.

PATTERN / SUBJECT	DAY/RELEASE N = 32	FULLTIME N = 39
MATHS	4.59	4.15
PHYSCIS	5.25	3.72
CHEMISTRY	4.72	4.08
BIOLOGY	5.06	3.61
ENGLISH	4.53	4.41
OVERALL	5.34	4.31

The 1980 G2 Examination was apparently better done by the fulltime class than by the day release class. When these mean grades were compared between the two groups per subject using the t-test statistic, it was revealed that not all the differences were significant. At a significance level of P = 0.05, it was found that the full time class was superior in Physcis, Chemistry, Biology, while the Maths and English were not significantly different between the two groups. On overall performance, the fulltime class had superior performance at significance level of P = 0.05.

TABLE 9: Results of the 1981 G2 Examinations.

The mean grade scores were calculated per course pattern per subject for the 1981 G2 examinations. Full results are shown in appendix 3. The mean values are indicated in table 8.

TABLE 9: 1981 G2 Examination mean grades obtained.

PATTERN / SUBJECT	DAY/RELEASE N = 37	FULLTIME N = 69
MATHS	4.76	4.22
PHYSCIS	4.05	4.54
CHEMISTRY	4.43	4.45
BIOLOGY	4.41	4.42
TEC/DRAWING	5.10	4.37
PRACTICAL	5.39	5.13
OVERALL	4.84	4.81
ENGLISH	4.78	4.25

The above mean grades were compared using t-test statistic. In Maths, Technical Drawing and English, the fulltime class had superior mean grades at P = 0.05.,.
The day release class had superior performance in Physics at P = 0.05, otherwise, there were no significant differences between the two course patterns.
The overall mean grades obtained by the course patterns were not significantly different.

TABLE 10: Results of the 1982 G2 Examinations.

The table below shows the mean grades obtained by the fulltime and day release classes in the 1982 G2 examinations.

TABLE 10: Mean grade results for 1982 G2 Examinations.

PATTERN / SUBJECT	DAY/RELEASE N = 36	FULLTIME N = 47
MATHS	4.94	4.09
PHYSCIS	4.42	4.34
CHEMISTRY	4.64	4.04
BIOLOGY	4.77	4.17
TEC./DRAWING	4.50	4.50
ENGLISH	4.67	4.38
PRACTICAL	4.53	4.56
OVERALL	5.19	4.68

The t-test statistic computation revealed that the fulltime class had superior grades to those of the day release class in Maths and Chemistry at P = 0.05 respectively. The superiority by the fulltime class in Biology was not significant. In all other subjects, including the practicals, there was no significant difference between the two groups. On overall grades, the fulltime class was superior at P = 0.05.

TABLE 11: The results of the 1983 G2 Examinations.

The table 11 below, shows the latest results obtained during the year of the survey. Nevertheless, the students sat for the examinations, these examinations were marked and the results released before the commencement of the study. Thus, the data presented here is a reflection of normal teachning by the teachers and examination performance by students in the two groups. The detailed analysis is shown in appendix 3.

TABLE 11: Mean grades obtained in the 1983 G2 Exams.

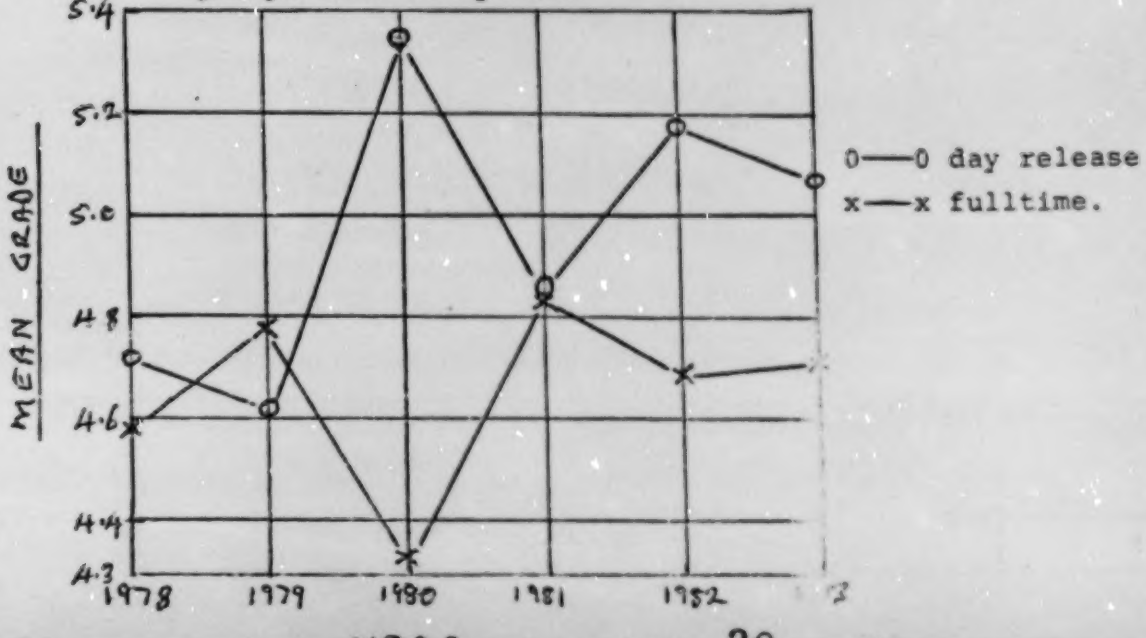
PATTERN / SUBJECT	DAY/RELEASE N= 43	FULLTIME. N = 44
MATHS	4.34	4.52
PHYSICS	4.37	4.43
CHEMISTRY	4.74	4.20
BIOLOGY	4.90	4.00
ENGLISH	4.65	4.27
TEC./DRAWING	5.23	3.67
PRACTICAL	4.14	3.98
OVERALL	5.07	4.70

The mean grades obtained by each group were compared as per subject, the practical and overall grade, using the t-test statistic. When the significance level of P=0.05 was considered as critical level, it was found that the fulltime class was superoir in Chemistry, Biology and Technical drawing. In all other subjects, therewere no significant differences. On overall grades awarded, there were no significant differences.

SUMMARY ON THE PRE-TECHNICIAN EXAMINATIONS.

The overall performance by the two groups over the 6 year period (1978 - 1983) shows a trend that is summarised in graph 3 below.;

Graph 3: Overall perforamance by day release and fulltime G2 groups over six years.

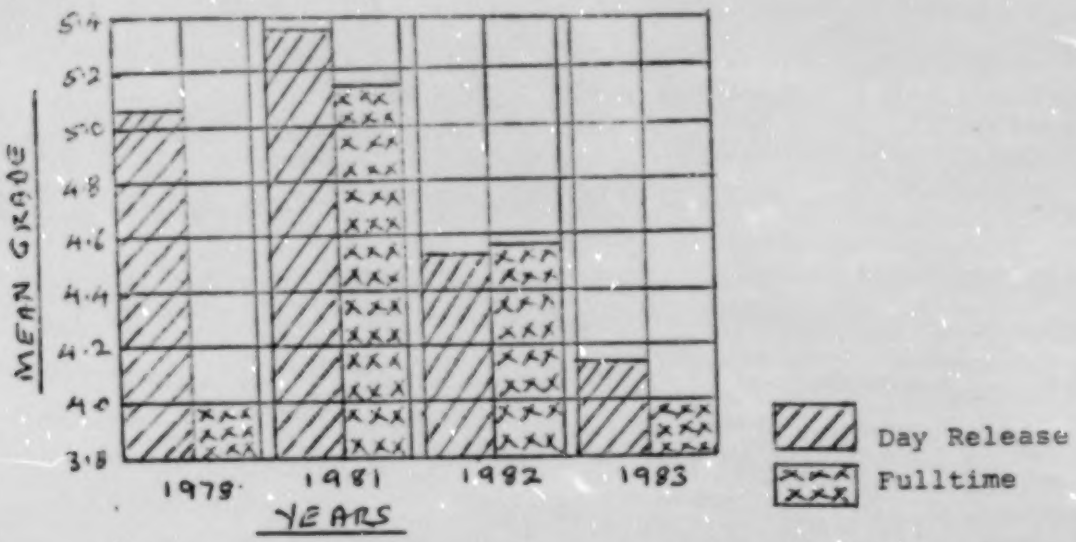


The above graph 3 shows that on overall performance, the fulltime classes have maintained a constantly better performance than the day release. This lead was significant in 1980 and 1982, at P = 0.05, Except for 1980 when performance was best, the fulltime clases have maintained a constant performance.

The day release clases show poorerperformance and this fluctuates alot from year to year.

The practical performance by both groups was available in 4 of the 6 years. The comparison between the two groups is shown in bar graph 1.

Bar graph 1: The G2 mean practical performance over 4 year period.



Over the four years the fulltime class was significantly better at practicals only in 1978 (P=0.05). Although it appears to be better in 1981 and 1983, these differences were not significant.

FINAL EXAMINATION PERFORMANCE BY THE BIOLOGICAL LABORATORY TECHNICIAN (BLO) STUDENTS.

The analysis of the Biological Laboratory Technicians (BLO) course presented in this survey cover only the performance in the Examinations of 1976, 1977 and 1979. These were the years when the course was taken in two patterns simultaneously. This was analysed so as to find out whether there were significant differences in performance at the end of the course between students taking the same course in different paterns. This is the first objective of the survey.

TABLE 12: The 1976 BLO Examination result.

The results of the 1976 BLO exams were available in raw form. Hence the higher the mean, the better the performance. The subjects for which data was available for both course pattern are chemical pathology, haematology, histology, parasitology, and laboratory animal management (Lab.AM). The 1976 students were the first students to take the course after the introduction of the new system.

Table 12 shows the mean scores by each class per subject. The detailed results are shown in appendix 4 a.

Table 12: Mean scores in BLO, 1976 Examinations.

PATTERN / SUBJECT	DAY/RELEASE N= 18	SANDWICH N = 14
CHEM.PATH.	51.17	62.00
HAEMATOLOGY	63.56	68.86
HISTOLOGY	61.61	63.29
PARASITOLOGY	69.00	69.57
LAB. AM.	68.11	66.21
OVERALL	62.69	65.99

The t-test was applied to these values to compare between the two course patterns. In chemical pathology the sandwich class attained superior results to day release class at P = 0.05.

In the other subjects, the mean scores were not significantly different between the two patterns.

The overall performance by the sandwich class was not significantly superior to the day release one at P = 0.05.

Table 13: The 1977 BLO Examination results.

The results obtained in the 1977 BLO exams are shown in table 13. These results were only available in the grade form. Grades:-

1 and 2 imply good and poor distinction.
3 and 4 imply good and poor credit.
5 and 6 imply good and poor pass, while
7 and 8 imply fail and poor fail

respectively. The lower the mean score therefore, the better the performance. In 1977, the papers were altered such that all subjects were conbined and examined in the form of 1st written 2nd written and practical papers. These results were computed to give the overall performance per student. In this survey, the individual scores were calculated to reflect the class mean scores with the standard deviations. All those calculations are shown in appendix 4.

TABLE 13; Mean grades obtained in 1977 BLO exams,

PATTERN / PAPER	DAY RELEASE N = 13	SANDWICH N = 13
1st witten	6.00	4.69
2nd written	5.77	5.00
Practical	5.54	4.92
Overall	5.85	5.08

In the 1977 examination, the sandwich BLO class had significantly better mean results than the day release at P = 0.05 in 1st written. In the other parameters, the two groups were not siginificantly diffirent.

TABLE 14: The BLO 1979 Examination results.

The mean results of the 1979 examinations are shown in table 13. As with 1977 results, these were available in grade form and therefore the lower the grade, the better the performance. Full data analysis is shown in appendix 4.

Table 14: Mean grades for 1979 BLO examinations.

PAPER / PATTERN	DAY/RELEASE N= 18	FULLTIME N= 19
1st written	4.44	4.35
2nd written	4.22	4.64
Practical	4.28	4.71
Overall	4.67	5.00

Although the dayrelease group appear to be superior to the sandwich in 2nd written, practical and overall results, the t-test revealed that these differences were not significant. Equally, the fulltime class was not superior to dayrelease in 1st written. The results of the 1979 examinations were therefore statistically the same between the two course patterns.

Summary.

The BLO examination for the three years considered are summarised in table 15 in terms of overall performance and practical performance.

TABLE 15: Overall and practical mean scores for BLO examinations over 3 years.

In this table, the 1976 results are given as a percantage while those of 1977 and 1979 are in the 1 - 8 scale grades.

PAPER/PATTERN / YEAR	OVERALL		PRACTICAL	
	DAY/RELEASE	SANDWICH	DAY/RELEASE	SANDWICH
1976 (%)	63	66	-	-
1977 (grade)	5.85	5.08	5.54	4.92
1978 (grade)	4.67	5.00	4.28	4.71

The diffrences seen in this table between the two course patterns were not significant. This was true for both overall grades and the practicals. Therefore over all the years analysed, there was no difference in performance between the BLO fulltime students and the day release students.

FINAL RESULTS FOR THE SCIENCE LABORATORY TECHNICAINS (SLO).

The SLO data was analysed so as to find out whether there were siginificant differences in exam and practical performance between students in different course patterns.

The format of the science laboratory technician course was altered in 1980. Consequently, the students of the old system graduted in 1981. This particular class was all day release. The first output of the new system will be in this current year. The course - patterns have always been day release and sandwich. The data analysed for this particular course involves the results of examinations taken between 1976 and 1980 inclusive.

The subjects taken in the SLO course were pooled and examined as as 1st written, 2nd written, practical and overall grade. This is the same pattern adopted by BLO in 1977.
Since the size of any one class was always less than 30 students, the t-test statistic was prefered throughout the calculations for determining whether mean values are different. The means and standard deviations are shown in Appendix 5.

TABLE 16: The Examination results for SLO 1976.

Table 15 shows the mean grades obtained by the candidates in the two different course patterns in 1976 SLO examinations. These were the first students to take the examinations after the day relese course was introduced. The lower the grade, the better the performance.

Table 16: Mean grades obtained in 1976 SLO exams.

PATTERN / PAPER	DAY/RELEASE N = 28	SANDWICH N = 20.
1 st written	4.75	4.65
2nd written	4.75	4.60
Practical	4.75	4.75
Overall	5.14	4.90

The slight superiority expressed by the sandwich class in the 1st and 2nd written and the overall grade are not significant. The practical mean performance is exactly the same for both course patterns. The standard deviations in the practicals were 1.32 for day release and 1.48 for sandwich. For 1976, there wasn't any difference between the two course patterns.

Table 17: Results of the 1977 SLO Examinations.

The mean grades obtained in SLO examinations for 1977 are shown in table 16. Other details are shown in appendix 5,

Table 17: Mean grades obtained in SLO 1977 Examinations.

PATTERN / PAPER	DAY/RELEASE N = 18	SANDWICH N = 20
1 st written	4.83	4.80
2nd written	4.78	4.75
Practical	4.61	4.30
Overall	5.00	4.90

Both the sandwich and day release classes show similar attainment in the 1st and 2nd written papers. The apparent superiority of the sandwich to the day release in the practical was not significant.

The overall performance was not significantly different bettwean the two patterns neither.

Table 18: The 1978 SLO examination results.

In the 1978 examinations, the mean grades obtained in each paper by each group was computed and then presented in table 18 below. Other details of the calculations are shown in appendix 5.

Table 18: Mean grades obtained in 1978 SLO exams.

PAPER / PATTERN	DAY/RELEASE N= 27	SANDWICH N= 22
1st written	5.07	4.86
2nd written	5.59	5.18
Practical	4.28	3.41
Overall	5.41	4.81

The examination results of 1978 reveal that the sandwich class had significantly better performance in the practicals than the day release ($p=0.05$). The difference in the 1st wrritten and 2nd written papers was not significant. The overall grade obtained by the sandwich class was also not significantly better than that of the day release class.

Table 19: The results of the 1979 SLO exams.

The SLO 1979 results were computed to give the means per subject per group. These are shown in table 19 below.

Table 19 Mean grades obtained in 1979, SLO Examinations.

PAPER / PATTERN	DAY/RELEASE N = 12	SANDWICH N = 15
1 st written	5.68	5.20
2 nd written	5.32	5.13
Practical	4.25	5.13
Overall	5.64	5.47

The attainment in 1st and 2nd written by the sandwich are not significantly higher than for the day release classes. But in the practicals, the day release class was superior to the sandwich class at P = 0.05. This statistically superior performance was reduced by the slight weakness in the 1st and 2nd written, so that the overall performance was not significantly different.

Table 20: Results of the 1980 SLO Examinations.

Table 20 shows the computed means for the different papers taken in 1980 by the sandwich and day release courses.

Table 20: Means grades obtained in 1980, SLO Examinations.

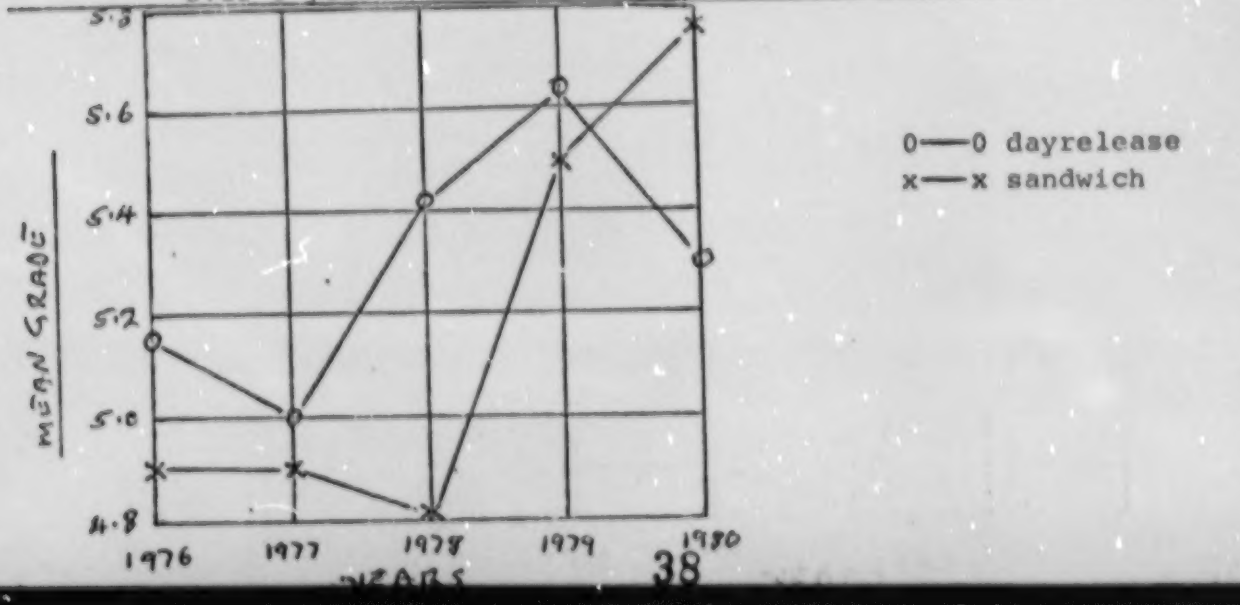
PATTERN / PAPER	DAY/RELEASE N= 12	SANDWICH N= 15
1st written	4.08	4.60
2nd written	5.83	6.27
Practical	4.50	4.47
Overall	5.25	5.73

From these mean values, it would appear that the day release is superior to sandwich. A t-test computation show that none of these mean grade values is significantly different from the corresponding mean in the alternative course pattern. Thus there was no real difference.

Summary of the SLO results.

The following graph 4 summarises the trend of the overall performance by the day release and the sandwich groups through a 5 year period (1976 to 1980). The lower the grade, the better the performance.

Graph 4: Mean overall grade for day release and sandwich SLO classes over 5 years.

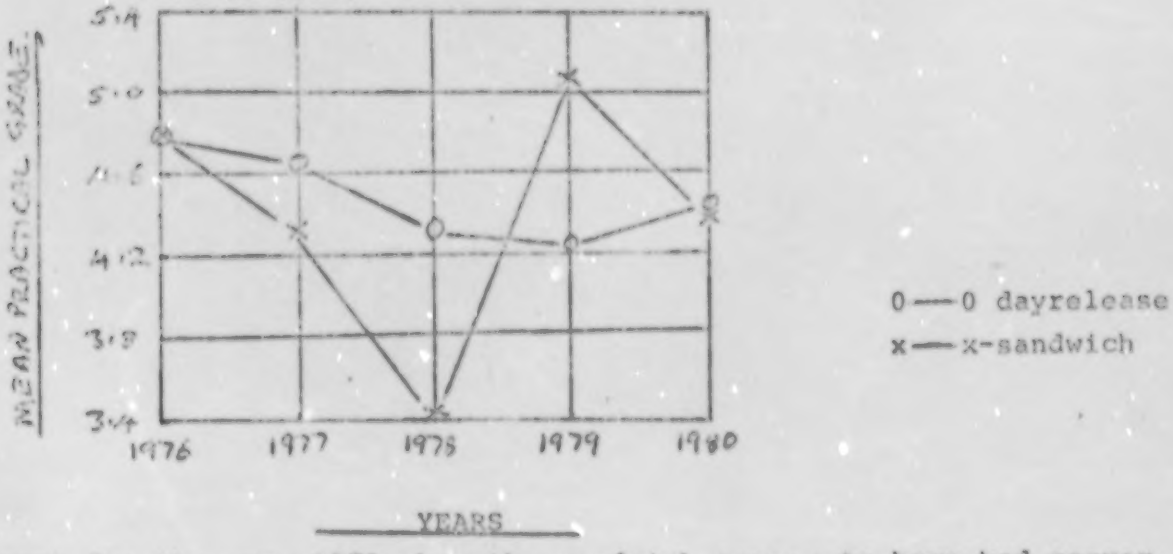


The sandwich pattern has maintained a lead over the day release pattern until 1980 when the dayrelease attained the better results. Nevertheless, over all the years analysed, the results from the two groups have never been significantly different.

Based on the trend of change in performance, the graphs cannot be extrapolated.

The practical performance is summarised in the

Graph 5: Mean practical grades obtained in the SLO course from 1976 to 1980.



Except for the year 1979 when the sandwich appear to have had poorer practical performance, all the other years show the sandwich as having had better results than dayrelease. This superiority was only significant in 1978 at P = 0.05. In 1978, the dayrelease was superior to the sandwich at the same confidence level.

The dayrelease practical performance has been very consistent over the 5 year period. The sandwich has shown very big fluctuations. while it appears that one may safely predict practical performance by SLO dayrelease classes, it is not possible to predict for the sandwich classes.

SUMMARY

HISTORIAL DATA.

The results of past examinations by different courses using different patterns were collected and analysed to establish whether there were significant differences in student performance.

The data obtained per class was analysed to show similarity or differences between two course patterns. The science Laboratory Technician (SLO) and the Biological Laboratory Technician (BLO) courses were taken in either day release or sandwich pattern. Using data from those two courses, comparison could only be made between dayrelease and sandwich patterns.

The Pre-technician (G2) and Junior Laboratory Technician (JLT) courses were only taken in either dayrelease or fulltime pattern. Consequently, comparisons could only be made between the two patterns.

It was considered logical to analyse each course alone per year and through several years first. Then, pool the overall grades for the courses with identical course patterns and do the same with the practical performance. Thus the BLO and SLO were pooled together while G2 and JLT were also pooled together.

The JLT Results.

In the 5 years examination results, there was a total of 28 comparisons between dayrelease and fulltime classes. Of the 28 comparison cases, 3 were on practicals. The rest were on individual subject level and on overall performance. Table C, shows the percentage cases in which course pattern was superior to the other.

Table C 1: Percentage superiority cases per JLT course pattern at 3 confidence levels.

PATTERN / CONFIDENCE level	DAYRELEASE %	FULLTIME%
P = 0.05	0	50
P = 0.10	0	53.6
P = 0.25	0	64.3

N = 28

At the acceptable confidence level of P = 0.05, the dayrelease classes were not superior to the fulltime classes in any one case. At that confidence level, the fulltime classes were superior to the dayrelease classes in 50% of the cases. Lowering the confidence level even to P = 0.25 increased the superiority cases for fulltime classes to 64%, while the dayrelease classes were not superior even in one case. Out of the 3 practical cases, the fulltime class was superior to the dayrelease in 2 of them at P = 0.05.

On the basis of both theory and practical examination, the JLT examinations show clearly that the fulltime pattern is superior to the dayrelease pattern.

The G2 Results.

The G2 examination results over 6 year period (1978 - 1983) were analysed. This period gave a total of 43 opportunities for comparison . Out of the 43, four (4) of them were overall practical performances. The superiority cases expressed by the dayrelease or fulltime classes respectively are shown in percentage form in table C2.

Table C2: Percent superiority cases per G2 course pattern at 3 confidence levels.

PATTERN / Confidence level	DAYRELEASE %	FULLTIME %
P = 0.05	2.3	30.2
P = 0.10	4.7	32.6
P = 0.25	7.0	44.2

N= 43

The figures above show that irrespective of the confidence level adopted, the fulltime course pattern had higher, number of cases in which it was superior. This is despite the fact that in the majority of cases, the dayrelease and fulltime classes did not show significant differences. Nevertheless, the fact that the fulltime classes are superior at acceptable levels of significance in 1/3 of all the cases over the dayrelease, makes it truly superior.

Among the four practical cases, it is only in one case where significant differences were observed at P = 0.05. In this isolated case, it was the fulltime that was superior. It would have been useful to increase the number of total practical cases for more comparisons. But when this one case of practical superiority is coupled with the theory superiority, then it adds credit to the conclusion that the G2 fulltime pattern is superior to the G2 dayrelease pattern.

The JLT and G2 pooled results.

Each of these two courses is taken in both dayrelease and fulltime patterns. The two courses are of the same duration and run at the same times. Although the course content is different the separate results shown above indicate the content difference is overshadowed by the pattern difference. Pooling the results of the two courses increase the emphasis on the superiority of fulltime pattern over the dayrelease pattern. These results are shown in table C3 for overall performance and [illegible] for practical performance.

Table C3: Superiority percentage cases by different course patterns in the JLT and G2 pooled results (α 0.05).

PAPER \ PATTERN	DAYRELEASE %	FULLTIME %
Theory N = 71	1.4	[illegible]8
Practicals, N=7	0.0	[illegible]2.9

The number of cases considered for the theory calculation was 71 while practical cases were seven (7).

These results indicate that the fulltime classes had better performance than the dayrelease in both the theory and practicals. Whether the superiority cases are considered at high or low confidence levels, in both theory and practical performance, the fulltime pattern was found to be superior to the dayrelease pattern.

The BLO results.

The BLO results were available for two different course patterns for only three years. These were the only years when both patterns were used simultaneously. When these results were analysed, the sandwich pattern showed more occassions of being superior to the dayrelease than vice versa.

Considering that there were 14 occassions in the 3 year when comparison was possible, there wasn't even one case in which the dayrelease was superior to the fulltime pattern.
Table C4 summarises the percentage cases in which either course pattern has been superior to the other.

Table C4: Superiority percentage cases by different course patterns in BLO examinations.

PATTERN / Confidence level	DAYRELEASE %	SANDWICH %
0.05	0	14.3
0.10	0	21.4
0.25	0	50.0

N = 14

The table shows that the sandwich pattern is superior to the dayrelease pattern. Although in most of the cases (especially at higher confidence levels) there are more cases of no significant difference, it is worth noting that whenever a difference occured it was the sandwich pattern that was superior.

The SLO Results.

The results obtained from the SLO examinations in the 5 year period (1976 to 1980 inclusive) shows that there is no significant difference between the sandwich and the dayrelease course patterns. Taken as subject per subject analysis, the percentage superiority cases by any pattern is not only equal to that of the other, but it is also negligible.

The total possible cases in which superiority could be demonstrated by either group were 20. In 5% of these cases, the fulltime classes were superior to the dayrelease classes. In 5% of the cases the dayrelease classes in turn were superior to the fulltime classes. This is at a significance level of P = 0.05. The P value calculated above implies only one case in the twenty. That value is both too little to use to draw a difference and balance by the same superiority in the alternative course pattern.

At a confidence level of P = 0.05, each of the course patterns was superior to the other, once. Since the total possible cases of practical performance were 5, it implies that in 60% of the cases, the two patterns were not significantly different. It is right to conclude that in the practical examinations, the dayrelease pattern is as good as the sandwich pattern.

For the science Laboratory Technician Certificate course therefore, there is no difference between the sandwich and the dayrelease course patterns in examination performance.

Pooled Results of the BLO and SLO Courses.

Since the BLO and SLO offer courses in the same two patterns, the results of the examinations were pooled. This was done so as to provide a wider comparison between the dayrelease and the sandwich patterns, irrespective of the course. The number of cases in which the course patterns showed superiority was calculated as a percentage of the total cases. The results of that analysis are shown in table C5.

Table C5: Superiority cases in the pooled SLO and BLO results (P=0.05).

PAPER / PATTERN	DAYRELEASE %	SANDWICH %
Theory	2.9	8.8
Practical	14.3	14.3

For the pooled analysis, the number of theory cases was 34 while practical cases were 7. This pooled results show that the sandwich pattern is slightly superior to the dayrelease pattern in theory performance. In practical performance, the two course patterns are not significantly different from one another. At a significance level of P= 0.05, each course pattern show the same percentage cases of superiority.

The results of the pooled SLO and BLO analysis would have to be taken with caution. This is due to the fact that the differences that appear between the course patterns are only from the BLO course and not from the SLO course.

Conclusion from the Historical data.

All the data analysed reveal that, for the C2 and JLT, the fulltime caurses are superior to the dayrelease courses. This is true both for the practical and overall performance. This conclusion is true for each course separately and for the two courses collectively.

The results from SLO and BLO indicate that while sandwich BLO was superior to the dayrelease BLO in theory and in practicals, the SLO course patterns showed no difference. In the pooled form, the sandwich pattern was superior to the dayrelease pattern.

There were no single courses where the full time and the sandwich patterns are used. The comparison between the two could therefore not be made.

The results of the sandwich and the fulltime patterns above cannot be compared since the two patterns are used on courses that are of very different levels, they take place at different times and they are of different duration.

ANALYSIS OF THE QUESTIONAIRES.

The questionaires used with the Higher National Diploma (HND) students were different from those used with Graduates of different courses. These were also different from the lecturers' questionaires. In all these questionaires, all that the respondents were required to do was to write after each statement or question either 1 or 2 or 3 or 4 or 5. These codes had different meanings:-

1 - implied very much/very many/very high/very often.
2 - implied much/many/high/often.
3 - implied average.
4 - implied little/few/low/occassionary.
5 - implied very little/very few/very low/rarely.

The lecturers' questionaire however did not require average responses but any of the other four.

The responses obtained were then added together for each statement or question and the mean response then worked out. The lower means ratings obtained were indications of better learning as opposed to higher ratings. For the questions where a rating of 1 or 2 indicate less learning, the value was changed to 5 or 4 respectively and vice versa. Where such conversions apply, a negative (-) sign has been put before the statement in questionaires in the appendix 6.

THE RESPONSE FROM LECTURERS.

The questionaire developed for lecturers was analysed and the results are presented in this section.

The purpose of the questionaire was to investigate the opinion of lecturers with regard to the three course patterns. This was the second objective of the survey.

The following analysis includes the opinion of lecturers towards dayrelease and fulltime Junior Laboratory Technician (JLT) course patterns, the dayrelease and fulltime Pre-technician course patterns and the dayrelease and sandwich science laboratory technician ordinary certificate (SLO) course patterns. The responses obtained with regard to Biological Laboratory Technician Ordinary Diploma Certificate (BLO) course patterns were insufficient for valid comparisons. The questionaires analysed were from lecturers who have taught in the department for a period of one to ten years. Where a lecturer has taught a course in both patterns, such a lecturer gave separate responses for each course pattern.

The information obtained was grouped into categories as b,c,d and e to correspond with the catagories of information stated in chapter 2. These categories were:-

- b - How prepared the teacher was for theory and for practicals.
- c - How fully the syllabus was covered (scope)
- d - How well the syllabus was covered (depth)
- e - The attitude of the lecturers to the respective patterns.

The information was rated such that the lower the mean value obtained, the better the performance or attitude respectively. A copy of the questionaire is attached as appendix 6.

Lecturers' opinion to the dayrelease and fulltime JLT course Pattern.

The table 4 below shows the mean rating of the response to the JLT course patterns by the lecturers in the Applied Science department in Kenya Polytechnic. The table shows the mean values with the corresponding variance against sample size. The categories have been coded as stated above.

Table 4: Rating of the lecturers opinion to the dayrelease and fulltime JLT course patterns.

PATTERN / CATEGORY	DAYRELEASE			FULLTIME		
	N	$\bar{x}$	σ_{n-1}	N	$\bar{x}$	σ_{n-1}
b	49	1.9184	1.0961	35	1.7714	0.9420
c	35	2.3143	1.1053	25	2.3200	1.0296
d	77	2.1688	1.0931	55	2.0000	1.0000
e	63	1.8730	0.9244	45	2.0667	1.0745

The mean values obtained for the dayrelease and fulltime classes were then compared for each category using Z statistic. At a confidence level of P = 0.05, the mean values obtained between the two course patterns for any one category were found to be the same. No significant differences were obtained.

This means therefore, that the lecturers were as prepared for theory and practicals for dayrelease JLT classes as they were for the fulltime classes. The lecturers covered the same amount of the syllabus and to the same depth for each course pattern. The rating in category e, imply that the lecturers attitude to the two course patterns was not significantly different.

Lecturers Opinion Towards The Dayrelease and fulltime Pre-technician Course Patterns.

The opinion of lecturers to the dayrelease and fulltime Pre-technician course patterns was analysed and results shown in table C2. Each category of opinion was analysed separately. The categories are the same as those used for JLT course patterns. The coding is also the same.

Table L2.

Rating of the lecturer opinions towards dayrelease and fulltime patterns for Pre-technician course.

PATTERN / CATEGORY	DAYRELEASE			FULLTIME		
	N	$\bar{X}$	σ_{n-1}	N	$\bar{X}$	σ_{n-1}
b	76	1.8421	0.9245	56	1.9821	0.8840
c	55	2.0364	0.8599	40	2.2500	1.0064
d	120	2.1833	1.0041	87	2.3908	1.0822
e	99	1.7980	0.8327	73	2.0685	0.9906

The mean values from the table L2 were compared between the two course patterns for each category of opinion. At a confidence level of P=0.05, there were no corresponding means that were significantly different. Therefore the lecturers of pre-technician courses were equally prepared for either pattern, covered the same scope and depth of syllabus with either pattern, and did not significantly differ in attitude between the two course patterns. From the four perspectives considered, the lecturers., did not view the dayrelease Pre-technician course pattern to be different from the fulltime pattern.

The Lecturers Opinion Towards the Dayrelease and Fulltime SLO Course Patterns.

The opinion of lecturers towards the dayrelease and sandwich patterns for the Science Laboratory Technician Ordinary Diploma Certificate (SLO) course were analysed to give mean ratings and variance. These results and sample sizes are given in table L3 below.

Table L3.

Rating of lectuers opinions towards the dayrelease and sandwich SLO course patterns.

PATTERN / CATEGORY	DAYRELEASE			SANDWICH		
	N	$\bar{X}$	σ_{n-1}	N	$\bar{X}$	σ_{n-1}
b	41	1.9268	0.9846	28	1.7500	1.0046
c	28	1.9286	0.9786	20	1.7500	1.0690
d	76	2.7237	1.0532	44	1.9545	1.0333
e	61	1.7213	0.7986	36	1.6111	0.9033

At a confidence level of P=0.05, the Z statistic computation revealed that the lecturer preperation for the sandwich classes was not significantly different from the lecturer preparations for the day release classes. The scope and depth of syllabus covered was not significantly different, nor was the attitude towards the two patterns. Therefore the SLO sandwich and day release patterns were not significantly different from each other.

SUMMARY.

Since there were not enough responses for Biological Laboratory Technician Ordinary Certificate (BLO) analysis, this course was not analysed for difference between day release and sandwich patterns.

The responses for the patterns in JLT, Pre-technician and SLO courses were anlysed for differences in lecturer preparedness, syllabus coverage and lecturers' attitude to each pattern. At a confidence level of P =0.05, none of the differences between these categories was significant for any of the three courses.

Therefore, according to the lecturers and on the basis of the four perspectives analysed, there was no significant difference between one pattern and the other for the same course.

RESPONSE FROM HIGHER NATIONAL DIPLOMA STUDENTS.

The analysis of the responses by the Higher National Diploma (HND) students to the questionaires is presented in this section.

The purpose of the questionaire was to investigated the 3rd objective of the survey: i.e. how much of the practical skills and theoretical knowledge is retained by the trainees with regard to each course pattern. The reponses were rated by grouping them into three catagories namely:-

b - how prepared the student was before a lesson
c - how much was learnt in theory and practicals.
d - how prepared the teachers were.

This analysis was conducted for all the courses. Unfortunately, not a significant number of JLT students ever continue to higher levels. Hence, the sample size of HND students who had done JLT course was inadequate for valid analysis. The analysis of the three other courses (pre-technician, BLO and SLO) is presented in tabular form under appropriate subheadings.

A copy of the HND students questionaire is attached as appendix 7. The values adopted in the analysis are such that the lower the value given, the better the attainment in the respective category for the respective course pattern. The mean values were then compared for significant differences between them.

Students Response to the Dayrelease and Fulltime Pre-technician Course Patterns.

The table SI shows the mean scores and variances for the ratings given to each of the pre-technician course patterns by the HND students. The categories used are same as mentioned in the introduction of this section.

Rating of the dayrelease and fulltime Pre-technician course pattern by HND Students.

PATTERN / CATEGORY	DAYRELEASE			FULLTIME		
	N	$\bar{X}$	σ_{n-1}	N	$\bar{X}$	σ_{n-1}
b	30	2.16	1.2987	10	1.8268	1.0855
c	54	2.3670	1.2096	17	2.3351	1.1368
d	24	2.1653	1.3709	8	2.6415	1.2950

The mean values in each category were compared between the day release and fulltime patterns. At a confidence level of $P = 0.05$, the students in the day release pattern were not significantly different from those in the fulltime pattern in any category. The differences in how prepared the students were, in how much was learnt and in how prepared the lecturers were, between the two course patterns were not significant. That therefore means that, what was learnt and retained by the dayrelease groups was not significantly different from what was learnt and retained by the fulltime group.

Opinion of HND Students Towards the BLO Dayrelease and Sandwich Patterns.

The table 52, shows the response of the HND student that had taken the BLO course in different patterns. The duration between completing the BLO course (and SLO course) is at least 2 years shorter than that for pre-technician course. This is because, a pre-technician student must do either the BLO or the SLO course before he can quality for HND course.

Tablw 52.

Mean rating of the dayrelease and sandwich BLO course patterns by HND students.

PATTERN / CATEGORY	DAYRELEASE			SANDWICH		
	N	$\bar{X}$	σ_{n-1}	N	$\bar{X}$	σ_{n-1}
b	140	2.407	0.945	28	2.330	1.057
c	253	2.7687	0.9966	49	2.6336	1.0244
d	115	2.6875	0.985	23	2.293	1.121

The mean values in respect of how prepared the students were before the lessons (category b) were not significantly different between the course patterns. This was found to be true also for what was learnt in theory and practicals and the teacher preparedness respectively, at the confidence level of P=0.05. Therefore, according to HND students, the dayrelease and sandwich course patterns were not different in respect to the three perspectives used.

Evaluation of the SLO Dayrelease and Sandwich patterns by HND students.

The response by HND students that took the SLO course was analysed and the results put in table S3 below. The mean values obtained for each course pattern are shown with the variance and the sample size.

Table S3.

Rating of the dayrelease and sandwich SLO course patterns by HND Students.

PATTERN / CATEGORY	DAYRELEASE			SANDWICH		
	N	$\bar{X}$	σ_{n-1}	N	$\bar{X}$	σ_{n-1}
b	134	2.4359	1.1328	85	2.3596	0.9448
c	248	2.6778	1.0337	150	2.7325	0.92336
d	113	2.6213	0.9347	69	2.6578	0.8656

These mean values were then computed using the Z statistic to find out whether the differences between course patterns were significant at a confidence level of P = 0.05. In all the three cat categories respectively, there were no significant differences between the dayrelease and the sandwich course patterns. Therefore the SLO students in the dayrelease course pattern were as prepared, and learnt as much as did those in the sandwich course pattern. The evaluation of the HND students was that the SLO lecturers for both course patterns did not differ significantly in their preparations and readiness to teach.

SUMMARY.

The Higher National Diploma (HND) students who were currently going on with their course provided their assessment of the patterns of their earlier courses. This was to provide information to help evaluate how much was learnt and retained by the students of each course pattern.

The analysis of the HND students ratings for the SLO, BLO and pre-technician course patterns showed no significant differences between the dayrelease and the fulltime patterns or the dayrelease and sandwich patterns respectively. According to HND students therefore, there were no sgnificant differences between the course patterns.

THE RESPONSE FROM GRADUATES.

The responses to questionaires developed for graduates of the Applied Science department were available for the JLT, Pre-technician BLO and SLO courses. The purpose of this analysis was to investigate the 3rd objective of the survey: to investigate how much of the practical skills and the practical theoretical knowledge is retained by the trainees with each of the three course patterns. To achieve that objective, the information obtained was grouped into four categories. These were:-

b) how prepared the student was before a lesson.
c) how much was learnt in theory and practicals.
d) how prepared the lecturers were.
e) how much the graduate has retained to date (self rating of the graduate).

For each category, the mean rating for day release was compared with the mean rating for the fulltime class or sandwich class respectively.

The analysis for each class was considered and presented separately under appropriate subheading. The lower the mean grade given, the higher the attainment. A copy of the graduates questionaires is included as appendix 8.

Analysis of The Graduates Response to Dayrelease and Fulltime JLT Course Patterns.

The table G1 below shows the mean rating for dayrelease and fulltime JLT course patterns by graduates of that course. The number of responses and the variance are also indicated.

Table G1.

Mean rating of the dayrelease and fulltime course patterns by JLT graduates.

PATTERN / CATEGORY	DAYRELEASE			FULLTIME		
	N	$\bar{X}$	σ_{n-1}	N	$\bar{X}$	σ_{n-1}
b	127	2.3502	1.3203	48	2.6792	0.9324
c	219	2.3747	1.2548	83	2.6916	1.0538
d	114	2.4304	1.3051	42	1.8381	0.8636
e	204	2.4353	1.3267	78	2.5821	0.9794.

The mean values for the dayrelease and fulltime courses were compared for each category using the Z statistic. It was found that in two categories, the mean differences were significant. At a confidence level of p= 0.05, the mean rating of (C) i.e. how much was learnt in theory and practicals was significantly higher for the dayrelease than for the fulltime groups.

At the same confidence level, the lecturers for dayrelease classes were better prepared than those for fulltime classes (i.e. categoryd). Otherwise, there were bo significant differences between the dayrelease and fulltime JLT classes.

Analysis of the Graduates Responses to Dayrelease and Fulltime Pre-technician Course Patterns.

The pre-technician course is taken in either dayrelease or fulltime pattern. The views held by the working people who took that course in either pattern were analysed. The mean scores, the variance and respective sample sizes are shown in the table G2 below.

Table G2.

Mean rating or the dayrelease and fulltime Pretechnician course patterns by graduates.

PATTERN / CATEGORY	DAYRELEASE			FULLTIME		
	N	$\bar{X}$	σ_{n-1}	N	$\bar{X}$	σ_{n-1}
b	45	2.2756	1.6671	40	2.413	1.1789
c	81	2.2988	1.0689	69	2.3865	1.0847
d	41	2.3561	1.0330	34	2.6505	1.0909
e	75	2.3467	1.0714	65	2.4866	1.1291

When the mean scores per category were compared between the course patterns, it was found that no pattern had a significantly different mean.

To the graduates of the pre-technician course who are working in the field, there were no significant differences between the two course patterns.

Analysis of the Graduates Responses to the Dayrelease and Sandwich BLO Course Patterns.

The evaluation of the dayrelease and sandwich BLO course patterns by the graduates of that course was analysed as given in table G3 below. Some of the respodents have taken the advanced certificate course also. What is common in this category of graduates is that they were not taking any courses at the Kenya Polytechnic at the time of the survey.

Table G3.

Mean rating of the dayrelease and sandwich BLO course patterns by BLO graduates.

PATTERN / CATEGORY.	DAYRELEASE			SANDWICH		
	N	$\bar{X}$	σ_{n-1}	N	$\bar{X}$	σ_{n-1}
b	54	2.3928	1.1595	16	2.8031	1.0211
c	97	2.4088	1.1081	28	2.8121	0.8620
d	48	2.4606	1.1849	14	3.0407	0.9619
e	90	2.4666	1.1177	26	2.8592	0.8735

The mean values were then compared to find out whether they were significantly different for each category between the two course patterns. A confidence level of P=0.05 was taken as the critical level.

The mean rating for category C (i.e. how much was learnt in theory and practicals), was found to be significantly higher for the dayrelease classes than for the sandwich classes. Although in all other categories the dayrelease pattern appear to be suprior, these differences were not significant.

Analysis of The Graduates Responses to Dayrelease and Sandwich SLO Course Patterns.

Like the BLO course, the SLO was taught in both dayrelease and sandwich patterns. The ~~opion~~ opinion of the students who did SLO course in either pattern was analysed and shown in table G4 below.

Table G4.

Mean rating of the dayrelease and snadwich SLO course patterns by the SLO graduates.

PATTERN / CATEGORY	DAYRELEASE			FULLTIME		
	N	$\bar{X}$	σ_{n-1}	N	$\bar{X}$	σ_{n-1}
b	132	2.5353	1.0901	112	2.4804	0.9792
c	234	2.5310	0.9676	194	2.5157	0.9331
d	117	2.6396	2.0707	103	2.5808	0.9445
e	216	2.5762	1.0115	171	2.5900	0.9708

The mean values were then computed using a Z statistic to establish whether the differences between two patterns were significant per category. At a confidence level of P=0.05, the mean valuse between the dayrelease and the sandwich patterns were not significantly different for any one category considered.

SUMMARY.

The opinion of the former students of the Applied Science department in the four courses were gathered using a questionaire.

This information was grouped into 4 categories and analysed using a Z statistic at confidence level of P=0.05. It was found that the mean rating of how much was learnt in theory and practicals was significantly higher for the dayrelease JLT classes and dayrelease BLO classes than the respective fulltime or sandwich classes. The teachers for the dayrelease JLT were also found to be significantly better prepared than those of the fulltime course pattern.

In all other respects, there were no significant differences between the course patterns for any category considered. This was true for the JLT, Pre-teachnican, BLO and SLO courses considered.

CHAPTER FOUR.

CONCLUSION.

This survey was undertaken with the aim of evaluating the dayrelease, the fulltime and the sandwich course patterns for the implementation of science Laboratory Technician curriculum. At the start of the survey, there was no evidence of significant differences between the three course patterns.

In order to find out whether there are significant differences, THREE objectives were adopted. The first objective was to investigate whether there were significant differences in mean scores at the end of course examinations. The performance at the final examinations revealed that fulltime classes were superior to dayrelease classes in both theory and practicals. The sandwich course pattern was also superior to the dayrelease course pattern in theory performance. There was no differences in practical performance between the sandwich and dayrelease course patterns. The superiority of the fulltime course pattern to the dayrelease was more pronounced than that of the sandwich pattern.

The differences in examination performance varied with the courses themselves. This is exemplified in the table T1 below.

Table T1

Percentage of cases when a course pattern is superior.

PATTERN / COURSE	DAYRELEASE %	FULLTIME %	SANDWICH %
JLT	0.0	50.0	-
Pre-technican	2.3	30.2	-
BLO	0.0	-	14.3
SLO	5.0	-	5.0

This table shows that, while the fulltime JLT was superior to the dayrelease pattern in 50% of all cases analysed, the fulltime Pre-technician was only superior in 30% of all the cases analysed. It is also evident that there were some cases of superiority of the Pre-technician dayrelease pattern over the fulltime while there was none in the case of fulltime JLT pattern.

While the sandwich BLO class was superior to the dayrelease in 14% of all cases considered, the sandwich and dayrelease SLO courses had equal cases in which they expressed superiority. Thus the superiority varied with courses.

The second objective was to investigate the opinion of lecturers with regard to the three course patterns. This was done by use of a questionaire. The response from lecturers indicated that on the basis of how prepared they were, the syllabus coverage and their attitudes to the different patterns, there was no significant difference between the course patterns. This was true for all four courses considered.

The third objective was to investigate how much of the practical skills and theoretical knowledge was retained by the trainess with each of the three patterns. The respodents for this objective were grouped into two categories. These who are currently taking Higher National Diploma (HND) course and these who are out in the field. By using different questionaires for the 2 groups, information regarding the three patterns was gathered and analysed.

According to the HND students, there were no significant differences between the course patterns in Pre-technician, BLO and SLO courses. This was on the basis of how prepared the students were before lessons, how prepared the lecturers were and on how much was learnt in theory and practicals. But, according to the graduates already out in the field, the dayrelease JLT and BLO learnt more in both theory and practicals than their respective fulltime and sandwich counterparts. The teachers for the dayrelease JLT were also better prepared than the fulltime ones. In all other respects and classes, there were no significant differences between the patterns.

DISC

In i ions of learning, the success in examinations is used as th e factor for determing the success of both the teac ne students and thereby, the entire institution. On th tor therefore, the course patterns could be rated from super inferior as:-

Full Sandwich - Dayrelease.

Yet i titutions like the Polytechnics, colleges of Technology and T colleges, the other most important factor for deter success is excellence in industrial or teaching perfo after college graduation. In this regard, the impl by Dayrelease JLY and BLO graduates (already in the s hat they learnt more in theory and practicals than counterparts is an indication that they have confidence in th s. This confidence is an indication of confi t their application of the knowledge they acquired from coll ey therefore seem to imply, that, they are better at infor erformance than their fulltime and sandwich coun respectively.

Com that it is the same JLT and BLO courses where major diff n final examination performance occured and the coun emerged best, two hypotheses could be advanced. Eith dayrelease JLT and BLO students became overconfident (and not do well in examinations), or the fulltime and s classes crammed for their examinations with no chanc nternalising the knowledge. If the first alternative hypo as true, then the dayrelease students should have real fter the industrial challenge, that they had not learn after all. In that case, they should have responded in co ty with the examination results. Neither did the fullt T, and sandwich BLO classes admit, that they had learn , although they had been superior in examination perfo . Thus the dayrelease classes implication that they and retained more of the theory and practical skill the fulltime and sandwich counterparts could be true.

While one may doubt the validity of graduates (from field) responses, differences in examination and practical performance cannot be doubted. Therefore, the response by lecturers and HND students that there were no significant differences between the course patterns may be doubted. Unlike the graduates in field and the examination results, the lecturers and HND students harbour an interest in the survey, in that they continue to be involved with the college. That interest reduces the validity of their response. But since they have indicated that there were no differences, one may conclude that they had adopted the neutral position.

Recommendations:-

The polytechnic is designed mainly for students who are employed. Any recommendations would depend on the praticular perspective and the course in question.

The fulltime and sandwich patterns are appropriate for the weaker student who needs a boost in examination performance. To an employer and to a trainee who intends to gain promotion in the same establishment, the dayrelease pattern have better results in industrial performance. Since the college would normally be interested in both the academic and industrial excellence, the different course patterns may be adopted. In that case, the college should ensure that the employers of the fulltime and sandwich students are aware of the need to give sufficient, and related industrial challenge to the trainees, in the course of their study. The college could also raise the passing chances of poor trainees by placing them in the fulltime or the sandwich course patterns.

The difference in examination performance between the dayrelease and sandwich patterns was not as profound as between the dayrelease and fulltime classes. Also, according to graduates in the field, the superiority of the dayrelease BLO to sandwich BLO, was only in what was learnt in theory but not in practicals. These findings point to the possibility that the longer the course, the lesser the difference between the course patterns.

That is an area that may require further investigations.

The evaluation of course patterns should be conducted each year when there is a group graduating. This would only involve the graduating student, the lecturer and the examination results. The questionaire for graduates in the field could be administered after a longer interval, like every 5 years. This would help the college in improvements on the teacher performance and re-structuring of courses in a systematic approach.

APPENDIXES.

APPENDIX 1: Junior Laboratory Technician Examination Results (1979 to 1983)- Grades.

YEAR/ SUBJECT	DAYRELEASE			FULLTIME		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation
1979	21			20		
Physics				20	4.45	1.39
Chemistry				20	4.35	1.39
Biology				20	4.40	1.31
Lab.Technol.				20	4.40	1.47
Draw/W/Shop				20	4.55	1.37
Overall	21	5.12	1.50	20	4.90	1.465
1980						
Physics	21	4.67	1.32	30	4.27	1.31
Chemistry	21	4.48	1.54	30	4.37	1.27
Biology	21	4.19	1.36	30	4.57	1.28
Lab.Tech.	21	4.71	1.46	30	4.17	1.37
Draw/W/Shop	21	4.52	1.57	30	4.43	1.66
Overall	21	4.90	1.42	30	4.67	1.30
1981						
Physics	22	4.64	1.18	32	4.34	1.52
Chemistry	22	4.23	1.48	32	4.63	1.24
Biology	22	5.18	1.10	32	3.97	1.31
Lab.Tech.	22	4.45	1.34	32	4.47	1.34
Draw/W/Shop	22	4.77	0.92	32	4.22	1.50
Practicals	22	4.45	0.74	32	4.31	1.03
Overall	22	5.09	0.87	32	4.72	1.08
1982						
Physics	25	4.96	1.06	17	3.71	1.36
Chemistry	25	5.12	0.97	17	3.41	1.33
Biology	25	4.88	1.27	17	3.76	1.30
Lab.Tech.	25	5.04	0.93	17	3.65	1.50
Draw/W/Shop	25	4.96	0.98	17	3.53	1.28
Practicals	25	5.04	0.54	17	4.12	0.78
Overall	25	5.44	0.71	17	4.64	1.66
1983						
Physics	47	5.11	1.03	27	4.19	1.27
Chemistry	45	3.84	1.51	27	2.77	1.50
Biology	47	4.94	0.84	27	4.37	1.36
Lab.Tech,	47	4.53	1.32	27	3.81	1.55
Draw/W/Shop	47	3.23	1.54	27	2.33	1.00
Practical	47	6.48	1.50	27	5.81	1.52
Overall	47	5.11	1.09	27	4.44	1.22

Appendix 2: Computation Formulae.

1. t-test statistic:

$$T = \frac{\bar{x}_A - \bar{x}_B - (\mu_A - \mu_B)}{S_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$Sp = \frac{(n - 1)\, s_1^2 + (n_2 - 1)\, s_2^2}{n_1 + n_2 - 2}$$

2. z = statistic:

$$z = \frac{\bar{x}_A - \bar{x}_B - (\mu_A - \mu_B)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

3. Standard deviation formula

$$\sqrt{\frac{\Sigma x^2 - (\Sigma x)^2}{n - 1}}$$

4. Arithmetric mean:

$$\frac{\Sigma x}{n}$$

Appendix 3: Pre-technician Examination Grade Results 1978 to 1983.

YEAR/ SUBJECT	DAYRLEASE			FULLTIME		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation
1978						
Maths	18	5.06	1.46	21	4.45	1.50
Physics	18	4.72	1.70	21	4.64	1.35
Chemistry	18	4.61	1.23	21	4.93	1.29
Biology	18	4.61	1.41	21	4.64	1.62
English	18	4.27	1.22	21	5.02	1.54
Practicals	18	5.06	0.87	21	4.00	0.55
Overall	18	4.70	1.70	21	4.55	1.36
1979						
Math	18	4.61	1.38	41	4.49	1.25
Physics	18	4.50	1.69	41	4.56	1.16
Chemistry	18	4.17	1.54	41	4.59	1.26
Biology	18	4.44	1.46	20	4.75	1.21
Workshop	18	-	-	21	4.38	1.20
English	18	4.11	1.37	41	4.63	1.26
Overall	18	4.61	1.29	41	4.73	0.98
1980						
Maths	32	4.59	1.16	39	4.15	1.41
Physics	32	5.25	1.30	39	3.72	1.02
Chemistry	32	4.72	1.49	39	4.08	1.26
Biology	32	5.06	1.16	23	3.61	1.16
English	32	4.53	1.39	39	4.41	1.46
Drawing	-	-	-	16	4.44	1.36
Overall	32	5.34	1.36	39	4.31	1.26
1981						
Maths	37	4.76	1.16	69	4.22	1.42
Physics	37	4.05	1.63	69	4.54	1.27
Chemistry	37	4.43	1.19	69	4.45	1.46
Biology	27	4.41	1.42	43	4.42	1.35
Tech.Draw.	10	5.10	0.99	26	4.37	1.65
English	37	4.78	1.34	69	4.25	1.42
Practical	37	5.39	1.42	69	5.13	1.32
Overall	37	4.84	1.07	69	4.81	1.07
1982						
Maths	36	4.94	1.17	47	4.09	1.33
Physics	36	4.42	0.87	47	4.84	1.67
Chemistry	36	4.64	1.51	47	4.04	1.43
Biology	22	4.77	0.87	23	4.17	1.83
Draw/Tech.	14	4.50	0.85	24	4.50	1.59
English	36	4.67	1.49	47	4.38	1.24
Practicals	36	4.53	0.61	45	4.56	1.06
Overalls	36	5.19	0.79	47	4.68	1.09

Appendix 3: Pre-technician Examination Grade Results 1978 to 1983. cld.

YEAR/ SUBJECT.	DAYRELEASE			FULLTIME		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation
1983.						
Maths	43	4.34	1.31	44	4.52	1.37
Physics	43	4.37	1.31	44	4.43	1.34
Chemistry	43	4.74	1.20	44	4.20	1.42
Biology	21	4.90	1.45	20	4.00	1.38
English	43	4.65	1.25	44	4.27	1.23
D/Tech.	22	5.23	1.11	24	3.67	1.13
Practical	43	4.14	1.07	44	3.98	0.98
Overall	43	0.60	0.83	44	4.20	0.88

Appendix 4: Biological Laboratory Technician 'O' Certificate Grade Results 1976, 1977 and 1979.

YEAR/ SUBJECT	DAYRELEASE			SANDWICH		
	N	Mean	Standard Deviation	N	Mean	Standard Deviation
1976						
Chempathlogy	14	62.000	12.428	18	51.166	14.284
Haematology	14	68.857	8.142	18	63.555	8.104
Histology	14	63.285	6.844	18	61.611	6.270
Parasitiology	14	69.571	4.164	18	69.000	6.221
Lab. Animham	14	66.214	9.292	18	68.111	8.457
Overall	14	65.985	5.075	18	62.688	6.382
1977						
1st written	13	6.000	2.000	13	4.962	0.854
2nd written	13	5.769	1.964	13	5.000	1.000
Practical	13	5.538	1.664	13	4.923	1.320
Overall	13	5.846	1.951	13	5.076	0.862
1979						
1st written	18	4.444	1.464	17	4.352	1.455
2nd written	18	4.222	1.308	17	4.647	1.455
Practical	18	4.277	1.178	17	4.705	1.571
Overall	18	4.666	1.371	17	5.000	1.695

Appendix 5: Science Laboratory Technician 'O' Certificate Grade results (1976 - 1980).

YEAR/ PAPER	DAYRELEASE			SANDWICH		
	N	Mean	Standard deviation	N	Mean	Standard deviation.
1976						
1st written	28	4.75	1.40	20	4.65	1.69
2nd written	28	4.75	1.73	20	4.60	1.70
Practicals	28	4.75	1.32	20	4.75	1.48
Overall	28	5.14	1.46	20	4.90	1.41
1977						
1st written	18	4.83	1.20	20	4.80	1.15
2nd written	18	4.78	1.77	20	4.75	1.29
Practical	18	4.61	1.69	20	4.30	1.03
Overall	18	5.00	1.33	20	4.90	1.16
1978						
1st written	29	5.07	1.67	22	4.86	1.49
2nd written	29	5.59	1.64	22	5.18	1.10
Practicals	29	4.28	1.58	22	3.41	1.18
Overall	29	5.41	1.64	22	4.81	1.30
1979						
1st written	28	5.68	2.04	15	5.20	1.42
2nd written	28	5.32	1.61	15	5.13	1.50
Practical	28	4.25	1.43	15	5.13	0.99
Overall	28	5.64	1.62	15	5.47	1.36
1980.						
1st written	12	4.08	1.31	15	4.60	1.18
2nd written	12	5.83	1.34	15	6.27	1.49
Practical	12	4.50	1.24	15	4.47	1.13
Overall	12	5.25	1.71	15	5.73	1.28

The purpose of this questionaire is to gather information that will help in the evaluation of the course pattern in the Applied Science Department. The information given here will only be used for the purpose of this study. It has nothing to do with the carreer of the individual lecturer. The information given will be kept in in strict confidentiality.

Please respond to the questions as fully and as sincerely as possible.

The information sought here relate to the Ordinary Certificate in Science Laboratory Technology (SLO) and Biological Laboratory Technology (BLO), the Junior Laboratory Technicians (JLT) and Pre-Technician (G2) courses.

If you have taught more than one of the above course e.g., SLO and G2 please fill in separate questionaire for each course.

1. This information relate to course ----------

2. The subject taught that course was ----------

3. I have taught this course for approximately ---------- years.

4. (Put a tick (✓) against the correct response).
The boy: girl ratio of the students have always been:-

1: 1
2: 1
1: 2

Lower than these ratios
higher than these ratios
varied widely from year to year.

5. (Delete appropriately).
over 50% of the students in anyone class, have often been from the same/different institution/s.

6. (Put a tick (✓) against the course pattern/s in which you have taught).

Day release

Sandwich

Full time.

7. (Answer these questions for the Day re lease classes only).
At the end of each statement, enter 1 or 2 or 3 or 4 where:

1 means 'very often'
2 " 'often'
3 " 'occassionally'
and 4 " 'rarely'.

a. I gave reading assignments for a lesson sometime before.

b. I gave reading assignments after a lesson.

c. I gave exercise or drill type of assignments.

d. Instructions for practicals were standardised hand outs (practical sheets).

e(-ve) Instructions for practicals were written on the chalkboard.

f(-ve) Students required supplementary practical instructions.

g. Students complained of too many assignments.

h. I marked students assignments.

i. We had class discussions on the assignments after students had done them.

j. There was enough time to handle individual student problems.

k. Experiments tended to succeed.

l. We did all the required practicals.

m(-ve) Students tended to have forgotten the previous lesson.

n. We had enough time for revision before the final examination.

o. Most topics of the syllabus were adequately covered.

p(-ve) By the end of the school term I felt tired of this class.

q(-ve) For administrative reasons, the first school week was <u>not</u> used for instructions.

r(-ve) For the end of term test, the final week was <u>not</u> used for formal teaching.

8. (Answer these questions for the <u>sandwich</u> classes only). At the end of each statement, enter 1, or 2, or 3 or 4 where:-

	1 means	'very often'
	2 means	'often'
	3 means	'occassionally'
and	4 means	' rarely

a. I gave reading assignments for a lesson sometime before.

b(-ve) I gave reading assignments after a lesson.

c. I gave exercise or drill type of assignments.

d. Instructions for practicals were standardised hand outs (practical sheets).

e(-ve) Instructions for practicals were written on the chalkboard.

f(-ve) Students required supplementary practicals instructions.

g. Students complained of too many assignments.

h. I marked students assignments.

i. We had class discussions on, the assignments after students had done them.

j. There was enough time to handle individual student problems.

k. Experiments tended to succeed.

l. We did all the required practicals.

m(-ve) Students tended to have forgotten the previous lesson.

n. We had enough time for revision before the final examinations.

o. Most topics of the syllabus were adequately covered.

p(-ve) By the end of the school ter, I felt tired of this class.

q(-ve) For administrative reasons, the first school week was not used for instructions.

r(-ve) For the end of term tests, the final week was not used for formal teaching.

9. (Answer these questions for the Full-time classes only). At the end of each statement, enter 1, or 2, or 3, or 4, where:-

	1 means	'very often'
	2 means	'often'
	3 means	'occassionally'
and	4 means	'rarely'

a. I gave reading assignments for a lesson sometime before.

b(-ve) I gave reading assignments after a lesson.

c. I gave exercise or drill type of assignments.

d. Instructions for practicals were standardised hand outs (practical sheets).

e(-ve) Instructions for practicals were written on the chalkboard.

f(-ve) Students required supplementary practical instructions.

g. Students complained of too many assignments.

h. I marked students assignments.

i. We had class discussions on the assignments after students had done them.

j. There was enough time to handle individual student problems.

k. Experiments tended to succeed.

l. We did all the required practicals.

m(-ve) Students tended to have forgotten the previous lesson.

n. We had enough time for revision before the final examinations.

o. Most topics of the syllabus were adequately covered.

p(-ve) By the end of the school term, I felt tired of this class.

q(-ve) For administrative reasons, the first school week was not used for instructions.

r(-ve) For athe end of term tests, the final week was not used for formal teaching.

10. THANK YOU VERY MUCH FOR YOUR CO-OPERATION.

APPENDIX 6 INTRODUCTION.

The scores given by lecturers were grouped into different categories. Some of the questions have a negative impact on the catergory considered. Against such questions a (_____ ve) sign is indicated before the question.

Categories:-

b. How prepared the teacher was for theory and practicals.
c. How fully the syllabus was covered (i.e. scope).
d. How well the syllabus was covered (i.e. depth).
e. The attitude of the lecturers to each pattern.

Each category required specific questions:-

b - a,d,e,f,k,m,o.
c - a,l,m,n,o.
d - a,b,c,h,i,j,k,n,o,q,r.
e - e,f,j,k,l,m,n,o,p.

THE MEAN RATINGS FROM LECTURERS' QUESTIONAIRES.

COURSE/ CATEGORY	DAYRELEASE			FULLTIME		
	N	MEAN	STANDARD DEVIATION	N	MEAN	STANDARD DEVIATION
JLT						
b	49	1.918	1.096	35	1.771	0.942
c	35	2.314	1.105	25	2.320	1.030
d	77	2.169	1.093	55	2.00	1.00
e	63	1.873	0.924	45	2.067	1.075
Pre-technician						
b	76	1.842	0.925	56	1.982	0.884
c	55	2.036	0.860	40	2.250	1.006
d	120	2.183	1.004	87	2.391	1.082
e	99	1.798	0.832	73	2.069	0.991
SLO					(Sandwich)	
b	41	1.927	0.985	28	1.750	1.005
c	28	1.929	0.929	20	1.750	1.070
d	76	2.224	1.053	44	1.955	1.033
e	61	1.721	0.799	36	1.611	0.903

APPENDIX 7 : HND STUDENTS QUESTIONAIRE

The purpose of this questionaire is to gather information that will help in the evaluation of the course patterns used in the Applied Science Department.

The information given will only be used for the purpose of this study and will not be used for, or against the student. No names are required. Please give your sincere answer to each question.

The information sought involves only the ordinary certificate in Science Laboratory Technology (SLT) and Biological Laboratory Technology (BLT), the Junior Laboratory Technician (JLT) and Pre-technician (GT) courses. If you have taken more than one of these course e.g. GT and BLT, please fill in the information for each course on separate questionaires.

1. This information relate to course ----------

2. (Delete what is not applicable)
   I took the course in Day Release/Sandwich/Full time Pattern.

3. (Put a tick (✓) against the person/s who did NOT object to you taking the course in the above pattern.

   Employer

   College

   Myself

   Write in the space below, your comments on how the course pattern was chosen ?

   _____

   _____

   _____

   _____

4. The course ended in the year 19--

5. Fill in the table as completely and accurately as possible, Where a subject is NOT applicable, leave the entire column blank.

In the boxes, enter 1, or 2, or 3, Or 4, or 5 where:-

1 means 'very well/high/many/much
2 means 'Above average'
3 means 'Average'
4 means 'Below average'
5 means 'very poor/low/few/little.

SUBJECT / FACTOR	MATHS	ENGLISH	CHEMISTRY	PHYSICS	BIOLOGY	W/SHOP	LAB.PRAC	HISTOL.	HAEMATOL	CHEM.PATH	PARASITOL	BACTERIOL	VIROLOGY		
1. Amount of assignments given.															
2. Amount of theory class hours compared to practical hours.															(-ve)
3. Number of times that the teacher appeared prepared.															
4. Amount of syllabus covered.															
5. Number of handouts given BUT not discussed with the teacher.															(-ve)
6. How many assignments did you ever finish ?															

SUBJECT / FACTOR	MATHS	ENGLISH	CHEMISTRY	PHYSICS	BIOLOGY	W/SHOP	LAB.PRAC.	HISTOL.	HAEMATO.	CHEM.PATH	PARASITOL.	BACTERIO	VIROLOGY			
7. How many assignments did the teacher discuss in class after they were done ?																
8. Amount of time available per practical or per exercise.																
9. Hours you felt you needed for private reading.																(-ve)
10. Hours spent on extra reading.																
11. Number of lessons that the teacher could not finish on time.																(-ve)

The scores given by respodents were grouped into different categories. Some of the questions have a negative impact on the category considered. Against such questions, a (-ve) sign is indicated after the question.

Categories:-

b - How prepared the student was before a lesson,
c - How much was learnt in thoery and practicals,
d - How prepared the teachers were,
e - Self rating - how much the student still retains.

Each category required specific questions:-

b - 1,3,5,6,7,9,11,12
c - 1,2,3,4,5,6,7,8,9,10,12,13,14,15
d - 1,3,5,7,9,11,12
e - 2,3,5,6,7,8,9,10,11,12,13,14,15.

THE MEAN RATINGS FROM HND STUDENTS' QUESTIONAIRE.

COURSE/ CATEGORY	DAYRELEASE			FULLTIME		
	N	MEAN	STANDARD DEVIATION	N	MEAN	STANDARD DEVIATION
Pre-technician						
b	10	1.827	1.085	30	2.16	1.299
c	17	2.335	1.137	54	2.368	1.210
d	8	2.642	1.295	24	2.165	1.371
BLC				Sandwich		
b	28	2.330	1.057	140	2.407	0.945
c	49	2.634	1.024	253	2.769	0.997
d	23	2.293	1.121	115	2.688	0.985
SLC				Sandwich		
b	85	2.360	0.945	134	2.436	1.133
c	150	2.733	0.924	248	2.678	1.034
d	69	2.658	0.866	113	2.643	0.935

Appendix B: QUESTIONNAIRE FOR GRADUATES OF THE APPLIED SCIENCE DEPARTMENT.

The purpose of this questionaire is to gather information that will help in the evaluation of the course patterns used in the Applied Science Department.

The information given will only be used for the purpose of this study and will not be used for, or against the student. No names are required. Please give your sincere answer to each question.

The information sought involves only the Ordinary Certificate in Science Laboratory Technology (CLT) and Biological Laboratory Technology (BLT), the Laboratory Technician (JLT) and Pre-Technician (GT) courses. If you have taken more than one of these courses e.g. GT and BLT, please fill in the information for each course on separate questionaires.

1. This information relate to course .....

2. (Delete what is not applicable)
I took the course in Day Release/Sandwich/Full time pattern.

3. (Put a tick (✓) against the person/s who did not object to your taking the course in the above pattern.

Employer

College

Myself

Write in the space below your comments on how the course pattern was chosen.

.....

.....

.....

.....

4. The course ended in the year 19--

5. Fill in the table below as completely and accurately as possible, where a subject is not applicable, leave the entire column blank.

In the boxes, enter 1, or 2, or 3, Or 4, or 5 where:-

1 means 'very well/high/many/much
2 means 'Above average'
3 means 'Average'
4 means 'Below average'
5 means 'very poor/low/few/little.

SUBJECT / FACTOR	MATHS	ENGLISH	CHEMISTRY	PHYSICS	BIOLOGY	W/SHOP	LAB.PRAC	HISTOL.	HAEMATOL	CHEM.PATH	PARASITOL	BACTERIOL	VIROLOGY		
1. Amount of assignments given.															
2. Amount of theory class hours compared to practical hours.															(-ve)
3. Number of times that the teacher appeared prepared.															
4. Amount of syllabus covered.															
5. Number of handouts given BUT not discussed with the teacher.															(-ve)
6. How many assignments did you ever finish ?															

83

SUBJECT / FACTOR	MATHS	ENGLISH	CHEMISTRY	PHYSICS	BIOLOGY	W/SHOP	LAB.PRAC.	HISTOL.	HAEMATOL.	CHEM.PATH.	PARASITOL.	BACTERIOL.	VIROLOGY			
7. How many assignments did the teacher discuss in class after they were done ?																
8. Amount of time available per practical or per exercise.																
9. Hours you felt you needed for private reading.																(-ve)
0. Hours spent on extra reading.																
1. Number of lessons that the teacher could not finish on time.																(-ve)
2. Number of relevant practicals compared to irrelevant ones.																

SUBJECT / FACTOR	MATHS	ENGLISH	CHEMISTRY	PHYSICS	BIOLOGY	W/SHOP	LAB.TRAC.	HISTOL.	HAEMATOL.	CHEM.PATH.	PARASITOL.	BACTERIOL.	VIROLOGY	
13. Number of practical instructions I can remember off-head.														
14. I can do that same final examination today.														
15. I can teach that course with confidence at Kenya Polytechnic.														

THE MEAN RATINGS FROM GRADUATES' QUESTIONNAIRE.

COURSE/ CATEGORY	DAYRELEASE			FULLTIME		
	N	MEAN	STANDARD DEVIATION	N	MEAN	STANDARD DEVIATION
JLT						
b	127	2.350	1.320	48	2.679	0.932
c	219	2.375	1.255	83	2.692	1.054
d	114	2.430	1.302	42	2.838	0.864
e	204	2.435	1.327	78	2.582	0.979
Pre-technician						
b	45	2.276	1.667	40	2.413	1.179
c	81	2.299	1.069	69	2.387	1.085
d	41	2.356	1.033	34	2.651	1.091
e	75	2.347	1.071	65	2.487	1.129
BLO						
b	16	2.803	1.021	54	2.393	1.160
c	28	2.812	0.862	97	2.409	1.108
d	14	3.041	0.962	48	2.461	1.185
e	26	2.859	0.874	90	2.467	1.118
SLO						
b	132	2.535	1.090	112	2.480	0.979
c	234	2.531	0.968	194	2.516	0.933
d	117	2.640	1.071	103	2.581	0.945
e	216	2.576	1.012	177	2.590	0.971

ACKNOWLEDGEMENTS.

I am grateful to African Curriculum Organization and the German Agency for Technical Co-operation for opening the avenues and providing the bulk of the finances for the entire course.

I thank my supervisor Dr. Kofi Quansah for valuable discussions and guidance he has provided throughout the research exercise.

I acknowledge with much appreciation the help given to me by the head of the Applied Science Department and the Registrar by providing me with the students records. I am also thankful to all the Training Officers from all the Institutions mentioned in this report for administering the graduates questionaires among the employees willingly and enthusiastically.

Much appreciation also go to my wife Wambui, and children, Muthoni and Kahuki for their perseverance and encouragement during the study and research period.

I am very gratefull to Miss Anne Siambi who very willingly typed all the questionaires and the final report.

There were there many other who directly or indirectly, knowingly or unknowillingly contributed greatly to the success of this research project.

I THANK THEM ALL.

REFERENCES.

HAMILTON, David; Curriculum Evaluation. open Book Publishing Ltd. London 1976.

BERGMAN, Herbert and BUDE Udo: Introduction to Methods and Processes of the Curriculum Development. A survey of Primary Schools and their communities for general Education Policy making: The case of two provinces in Cameroon. ACO Nairobi 1979 pg. 3 - 34.

KENYAS DEVELOPMENT PLAN - Part I 1979 to 1983, Training and Institutions. Government Printer, pg. 481 to 497.

KENYA POLYTECHNIC AID PROPOSALS AND DEVELOPMENT PLAN - 1974 - 1978.

K.I.E. - Agricultural Engineering Technicians course: Regulations and syllabi, KIE 1980.

K.I.E. - Construction Plant Technicians Course KIE 1980.

K.I.E. - Fabrication and Welding Engineering Technician Certificate, KIE 1979.

K.I.E. - Mechanical Engineering Technician Courses KIE. 1980.

K.I.E. - Ordinary Diploma in Applied Sciences, Regulations and syllabi. KIE 1980.

K.I.E. - Ordinary Diploma in Civil Engineering Regulations and syllabi, KIE 1980.

K.I.E. - Higher Diploma in Electrical Engineering Technician Courses. KIE 1979.

STENHOUSE - Lawrence. An Introduction to Curriculum Research and development. Heneman Educational Books Ltd., London 1975 . page 98 - 142.

UNESCO - The Design of Engineering Curricula : Implementation and Evaluation UNESCO 1977. page 102 - 111.

HOEL P.G. Introduction to Mathematical statistics John Wiley International.